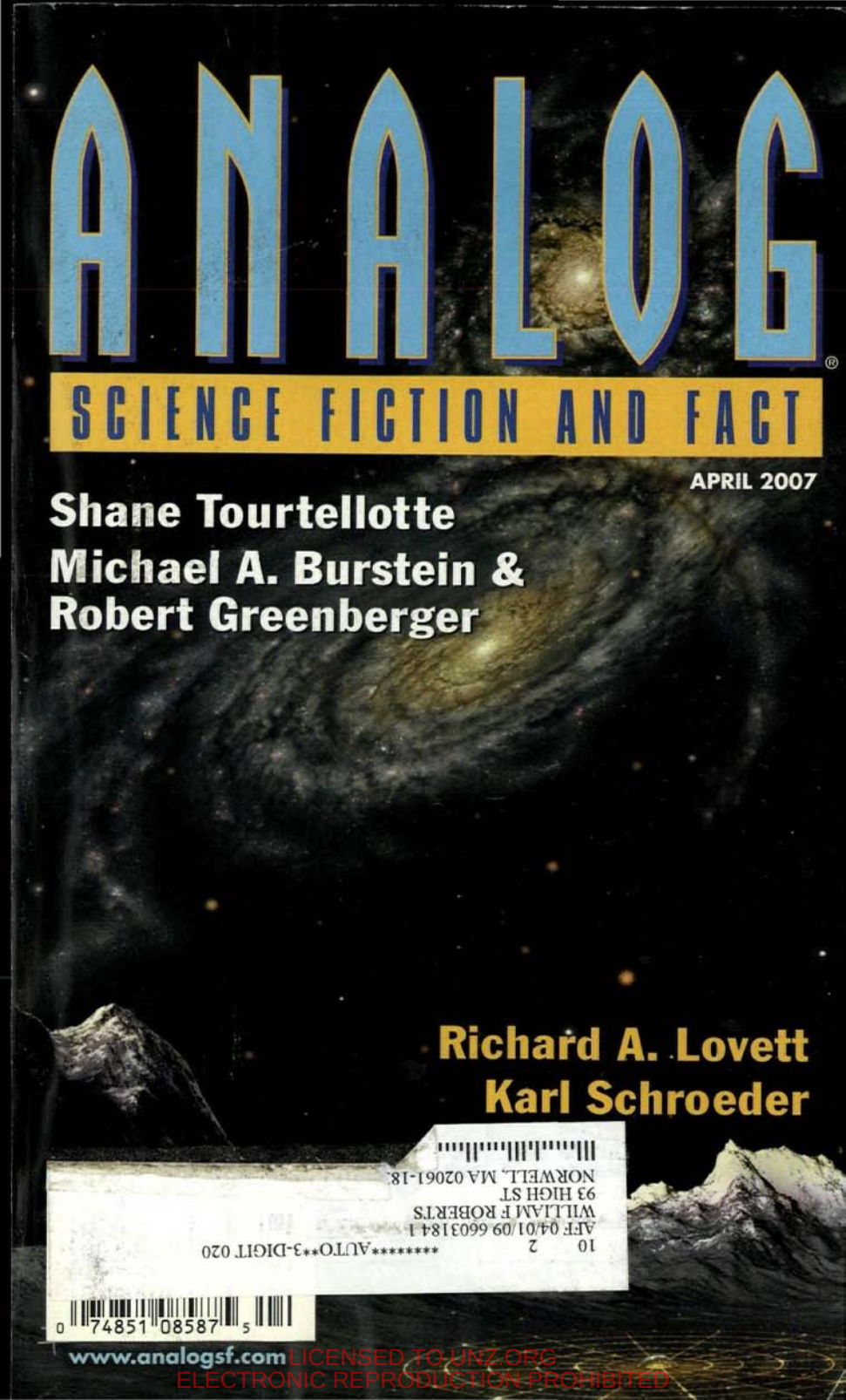

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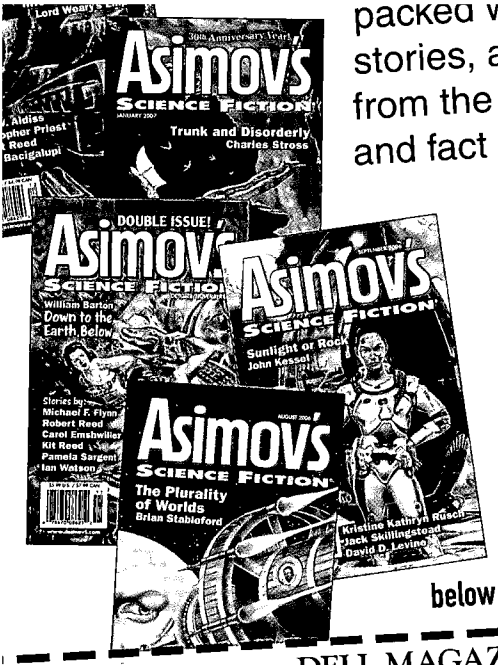

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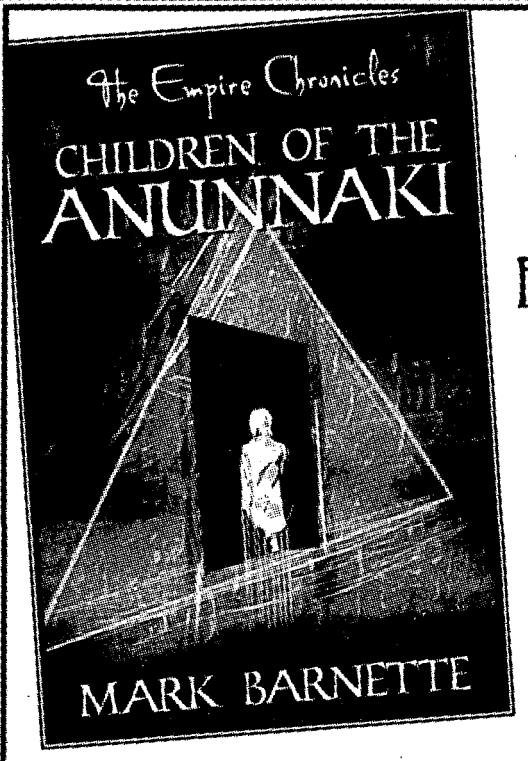

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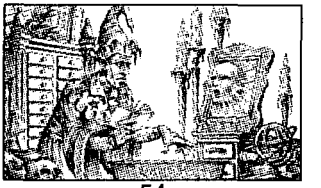

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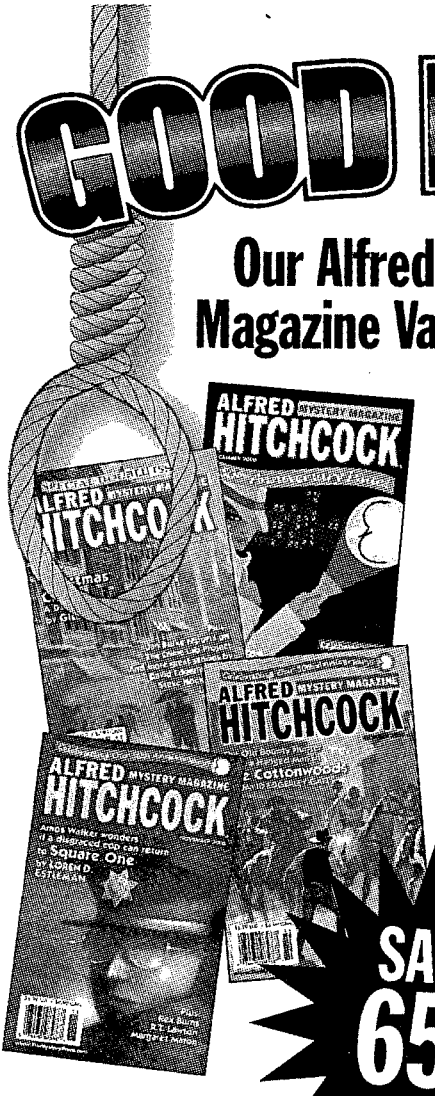

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EDITORIAL Stanley Schmidt

CITIZEN SCIENCE

Last summer Joyce and I did some volunteer work as part of a research program carried out under the joint auspices of a well-known university, a federal government funding agency, and a state park system. The subject of investigation was the prevalence and impact of invasive plant species on native ecosystems in the park; but there was another subject, too: us.

While the investigators' primary interest was in ecological disturbances, they were also using the project to study the effectiveness of a slightly unorthodox system of data collection. The initial data they wanted was the presence and abundance of invasive plants at a multitude of marked points along park trails—but they wanted data from a lot more points than their paid staff could reach in the available time. So they recruited volunteers—hikers more or less familiar with the area under study—and trained us in the study protocol and identification of the twenty-some species of plants under interest. Then they assigned pairs of us to scrutinize designated checkpoints along particular stretches of trail, keeping records of which invasive species we found, and how much of each, at each point.

By using large numbers of volunteers, they could collect data from many more points, more evenly distributed over a larger area, than the principal investigators could hope to cover themselves. But since the "citizen scientists," as they called us, would have much less training and experience than specialists in the field of study, there would naturally be questions of how reliable the data we collected would be. So the project had to include an attempt to evaluate that, too. One way they did that was by having *all* the volunteers, and the professionals, survey the same "control" section of trail in addition to the one for which they had primary responsibility. That way they could see how each volunteer team's results compared with the pros' results for the same piece of land.

We've only started hearing the term "citizen scientist" recently, but the concept is much older. Originally there were *only* citizen scientists: people like Leonardo da Vinci, William Herschel, Thomas Jefferson, and Benjamin Franklin, who had other means of support (such as royal patronage, family fortunes, farming, politics, or playing church organ) and studied science because they wanted to and could. It's only fairly recently that "scientist" became a distinct, generally recognized profession for which people could train and in which they could reasonably expect to find regular employment. It's even more recent that much scientific research became so complex and dependent on expensive equipment that only people with years of specialized training and skill in writing grant proposals could do it. Eventually that tendency became so pervasive and pronounced that most people assumed that *all* science was like that.

Through it all, though, amateurs con-

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tinued to make important contributions in some fields. Astronomy, for instance: most professional astronomers are concentrating so hard on specific objects in tiny regions of the heavens that they don't have time to scan the whole sky for unexpected anomalies that might turn up at any time or place—so *most* new comets have been discovered by amateurs. Studies of changes in bird populations depend heavily on observations by large numbers of recreational (but often highly skilled) birders. Recently SETI, the search for extraterrestrial intelligence, has been greatly expanded by enlisting large numbers of "real people" to let otherwise unused time on their computers be used to sift through potential signals.

It's now becoming apparent that the nonspecialists are potentially valuable sources of information in many other fields. The rationale for using them in our plant survey applies, for example, in a great many environmental areas, where we urgently need to understand what's going on in very large, complex systems, and there simply aren't enough pros (or funding) to collect as much data as we need in order to do that. Which is probably why, since we first heard the term, we've been hearing quite a bit about "citizen science."

So how good *is* data collected that way? The main difference between information collected by "citizen scientists" and that gathered by "real" scientists is likely a greater variability in its quality. The term "citizen scientist" can be misleading in either direction, both because of the nature of the work and because of the diversity of backgrounds of the people who agree to do it. In this project we were functioning solely as data collectors, and that's just the beginning of science; somebody else was doing the analysis to try to determine what the data meant. And we ranged from "real" scientists working outside our usual specialties, to people with no scientific background beyond what they got in grade school a long time ago, supplemented perhaps by occasional articles in more recent news media.

This disparity poses a bit of a practical problem in a project like ours, which a wide range of people come into for a wide variety of reasons. (It's less of a problem for amateur astronomers and ornithologists because they have self-selected themselves for interest in those fields and in many cases spent years developing skills at a practically professional level.) For the "evaluating-citizen-science-as-a-method" aspect of our study, our orientation and debriefing sessions included not just plant identification and an introduction to the project plan, but several questionnaires designed to measure people's knowledge about and attitudes toward science generally, before and after the project. For some of us, who've been working in the sciences one way or another for decades

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(e.g., I'm a physicist currently editing *Analog* and Joyce is a medical technologist working in a research lab), these questionnaires were genuinely tedious. We felt as if, after spending years earning advanced degrees and professional certification and then using them, we were suddenly being forced to take fifth-grade general science tests. On the other hand, we know from conversations among some of our colleagues that many of the questions asked were really things they hadn't thought about before. For us, this too was educational: a reminder most scientists probably need from time to time of just how little they can for granted about their fellow citizens' understanding of what they do. And since scientists depend on their fellow citizens for support in a multitude of ways, that's important.

And it does not necessarily imply that the volunteers without much scientific background were less important to the project. Probably *most* of the volunteers, ourselves included, were less good at what we were doing than the experts running it would have been. Neither Joyce nor I claim to be a botanist, and while I think we did a pretty good job of learning those plants and recognizing them in the field, I don't doubt that we overlooked a few that our project leaders would have seen at a glance. So yes, the data collected by "citizen scientists" probably aren't quite as good as those collected by experts in their field. But there are a lot more of us than them, and we face a lot of really big problems. For many of those, data collected by volunteers, even if less than perfect, are a lot more valuable than no data. So I foresee that in the years to come, more and more of "us" will be needed, if only to help the pros decide where to concentrate their efforts. ■

Human history becomes more and more a race between education and catastrophe.

—H. G. Wells

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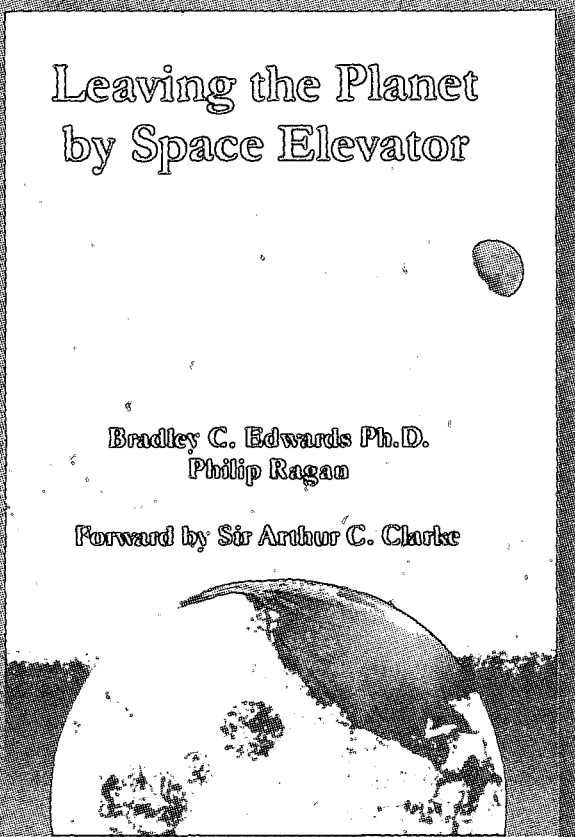

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Trial by Fire

Shane Tourtellotte

Extraordinary shocks lead to extraordinary temptations. . . .

I

The lab was in a quiet, controlled tumult. Subjects had been flowing in and out of the scanning room all day, and Lucinda Peale hadn't been out of the monitoring booth for a good five hours. She was going on inertia today, the inertia of years of doing work she had believed in.

They were scanning the last of the violent criminals on their volunteer list, filling in gaps of their knowledge of the structure and function of such brains. The team had been doing such scans for seven years, and for the last five had been treating violent pathologies and other conditions with neural overlays. Knowing the patterns of nerve connections and chemical signals in an unhealthy brain allowed one to impress those unhealthy areas electromagnetically with a pattern known to be healthy.

As much as they knew, and as practical as their knowledge proved, the brain was still profoundly complex, with more subtleties the deeper one looked. Their lab, and those at half a dozen other universities, had not charted the whole territory yet. They certainly wouldn't finish the job today, but they might answer a few more questions.

Dr. Leonard Urowsky shared the booth with Lucinda, sitting at the far end of the console. He adjusted one monitor to trace dopamine and noradrenaline release in the orbito-frontal cortex, as Dr. Dreher in the scanning room talked a subject through memories of a particularly grisly crime. He began to sag with fatigue.

"Just one more after this," Lucinda whispered.

"Oh. Good, Dr. Peale." He rubbed his lined face, getting a little energy back. "Then we can finish this report and have it for the committee on Fri-

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day."

The project had been politically charged from the outset. Altering minds, constructive as it could be when the minds were diseased, still held terrors. Politicians and ethicists feared its potential misuses, usually meaning any uses they disapproved of. The public saw it as a version of brainwashing. "Mind-wiping," they called it, though "mind-cloning" was a popular alternative.

She and colleagues had spoken before state boards and legislative committees often in the past. This time, though, it went beyond California, all the way to Washington and the House Science Committee. The research team was sending its full ethics sub-group to testify: Urowsky, Dreher, and Pavel Petrusky. Dr. Petrusky had arranged the testimony, with his usual political skill.

Lucinda was not going. In her darker moments, she felt that Pavel had also arranged that with his usual political skill.

Urowsky spoke again. "And make sure to send us the results of tomorrow's synesthesia work. We can show—"

Pavel Petrusky opened the door. His eyes barely touched Lucinda before going straight to Urowsky. "Ah, Pavel," Urowsky said, "how did the procedure go?"

"Very well. The patient should be awake now, and Dr. LaPierre will be there to check her cognition. I needed to get back for these last scans."

Urowsky looked at the main monitor, where Dreher was showing in another manacled, orange-suited man. "Last scan. Please, sit." Petrusky put himself neatly between Urowsky and Lucinda, never turning his eyes left to her. "I was just reminding Dr. Peale to send the synesthesia data ahead to us in D.C."

"Oh, absolutely." He took the briefest look at Lucinda. Pavel had always lobbied for study in areas away from violence and insanity, things that would taint their work with judgmentalism. "We need to let the committee know all we've done, and can do. It's an important opportunity."

He gave her another sidelong glance, and she could tell he didn't mean that in the strictest professional sense. His ideas of the social, and even political, uses of overlay were far different from hers. Pavel treated the field as engineering, with the human brain as a complex mechanism whose workings should be adjusted and perfected. And he had his own definitions of perfection.

There had been a power struggle within the team, one Lucinda had lost. Pavel had gained unspoken control over the program at Berkeley, and its agenda. The testimony in two days would be the fruit of his labors.

Pavel and Urowsky were talking softly among themselves. "Fortunate we're only losing two weekdays to travel and the hearing," Urowsky said.

"I knew it would be more convenient for us this way," Pavel said. "It also sets up the issue perfectly for the weekend cycle of news analysis. People will be thinking about overlay on our terms for once."

Lucinda wanted to bolt. She bit her tongue and concentrated on signs of hyperactivity in the amygdala to keep herself in her seat. Soon enough, the work was done. "I'll organize the scan files," she told Urowsky.

"Yes, thank you," he said absently. His attention was still with Pavel. Urowsky led the overlay project in title. Lucinda wondered whether he knew yet who led it in fact.

She retreated to her office to get that work done. Moments later, there was a knock. "Sam."

"Come in."

Sam Jeung slid inside. He looked down the hall both ways, then shut the door. "It's all set. We should have five dual-casting outlets, a couple radio, a

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couple print. The news conference will be in the courtyard, or the lobby if the weather's bad."

Lucinda frowned. "I had hoped for more."

"You don't need more to make a big media splash. This is enough for full propagation." He paused in his headlong discourse, almost a full second. "If you mean you hoped for more team members walking out, you could still approach Barber. She might go."

"And if Kate doesn't, she'd expose us early. The whole plan's predicated on maximum impact, striking right after the testimony. We have to play it safe here." She took her own pause, holding up a hand to keep Sam from rushing onward. "Speaking of that, you don't really have—"

"Stop. You're not getting rid of me, Doc."

"Sam, you'd be walking away from your doctorate work. You have lots more to lose."

"So what?" Sam grimaced at how loud he had said that, and toned it down. "I'm not going to let Petrusky and his ilk set up their orthodoxy as the standard to which all right-thinking folk have to conform. That's what'll happen in the end, unless we derail it *now, get some control back.*"

Lucinda nodded gently. "I know. I just wanted to give you the chance."

Sam grinned. "You're giving me the chance, and about time." Had Lucinda not reined him in, he might have tried something like this alone months ago. "And I'll get by. I'm going to be famous, after all, or at least notorious. Someone will take me on, just for the publicity. It'll be even better for you."

Lucinda tried to mirror his smile. "I can hope."

"We've had this conversation before." Joshua Muntz paid out some of the leash. "I'm not gonna abandon you because the going gets rough. I owe—you deserve better than that."

It was a chilly evening, so Lucinda and Josh walked close, arms loosely around each other's waists. Ben, her Rottweiler, snuffled at the neighbors' greenery.

"I just want you to understand, if they put me under a microscope after tomorrow, they'll probably put you there too. You haven't done anything to deserve that."

"I've been under that microscope," he said tightly. "The first time, I did deserve it. This time around might be easier, with a clear conscience." He ruminated. "If you're really saying you want me to lay low a while, for your sake—"

"No!"

It was the shortest lie she had ever told. Josh had been a patient of her team, cured of a murderous schizophrenia that had kept him institutionalized for thirteen years. Lucinda had seen him through the rough times after his rehabilitation, and over time he had become her . . . what?

Her lover? Not in the usual, physical sense, and she wasn't yet sure about the emotional sense, either. Such distinctions would probably matter little to the enemies she would make among her colleagues the next day. They could condemn her for a breach of ethics, and might make it stick. In a battle over ethics, it was a potent threat.

Pavel would have a tool to destroy her, and not the only one. Even without this, she'd likely be outmatched.

"You've got no reason to go into hiding," she said as they turned up the path to her small house. "And I can handle whatever happens."

Josh pulled her closer. "You don't need the false front with me, Luci. You're giving up your job, risking your professional reputation. You've got everything on the line."

She stopped at the front step. "Do you think I shouldn't do this?"

Josh needed a moment to meet her

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eyes. "I know someone should. I know better than most, this thing is too powerful to leave in the hands of people eager to use it. You're just being braver about it than I would."

Lucinda turned away, ostensibly to open the door. She had been eager about overlay in the beginning. Never as eager as Pavel and others, perhaps, but she had believed in it. She still did, within bounds.

Ben stumbled going into the house. "What's wrong, pal?" Josh said, kneeling beside him.

"He's starting limping on that front paw," Lucinda said. "Just getting older, I guess."

"Oh, no, you're not," Josh told Ben, and started tickling him. Soon Ben was lolling on his back, his coat scruffy from Josh's attention. Josh slowed to vigorous rubs, then firm pats, his face wilting into sadness as he slowed down.

Lucinda watched it all. "You didn't come here tonight to exercise my dog. You look like you're having a rough time too. Is it your parents?"

Josh's hand stopped, and he barely noticed Ben squirming free and trotting away. "Dad finally left the house. He's insisting I come with him. Mom's insisting I stay."

He had returned to his parents after being released from the institution, for family support in reintegrating into society. It had instead reopened their old wounds.

"I'm gonna make someone furious," he said, standing up. "I could look into finding my own place, but even custodial supervisors don't make that much, and my electronics course eats into that. I . . ."

As he searched for words, Lucinda put her arm around him, rubbing gently. She then took a step back. "If you need a place, Josh, you can always come here."

She watched him absorb that and begin struggling inside. She had all but invited him into the physical intimacy he had been avoiding. The attacks his past self had committed had been against women, which made him feel undeserving of a woman's trust and favor. His connection with Lucinda was slowly dissolving that rationale.

Beyond that, though, was what the overlay had left behind: shadows of the mind whose neural template was used to correct his. That person had had unfamiliar ideas, including quite progressive attitudes on sex, that Josh had been disturbed to find running through his head. He usually mastered all the stray thoughts, and if he perhaps overcompensated in the area of sex, Lucinda let him. The last thing she wanted to do was disregard his conscience.

"Sorry," he stammered, "I'm just thinking. It's a little tough to decide, not knowing what rent I'll be paying."

Lucinda nearly corrected him, but held back. If these were Josh's terms, including what lay unspoken, she would take them. She wouldn't tell him so, but that extra money might be handy to her soon.

"I hadn't thought that far ahead," she said. "Give me a few days to figure it out."

"No problem," he replied. "Not like I expect an answer tomorrow." They both laughed, the two strains of tension canceling each other.

"But just in case . . ." Lucinda went to her purse on the dining room table, dipped in, and took out a key. "If the tug-of-war becomes too much, you can come here for relief, however long you need."

Josh took the key tentatively. "Even if the news trucks are staking you out?"

"I'll trust your judgment."

His cheeks colored. "Thank you." He gave her a slow, gentle kiss. "You're probably busy tonight, so I can go."

"Not at all," she said, taking his arm and walking toward the living room. "I could use some company for a while."

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* * *

It was a dark six forty when Lucinda pulled into the parking garage and walked to her familiar campus lab. She lingered a moment, looking through the gloom at the grassy courtyard bounded by three buildings. *Five hours,* she told herself.

Coming out of the stairwell, she almost bumped into Kate Barber. Kate was walking down the hall, engrossed in talking to someone on a cell-pic. Lucinda swerved into a parallel course to avoid a collision, but got close enough to hear who was on the other end: Dr. Petrusky.

"—to snow, but it looks like it'll miss us. We should have no trouble with our return flight."

"Great, Pavel. Hold on. Lucinda, it's Pavel," Kate said, reeling Lucinda in before she could move off. "They're in the Rayburn Building, ready for the hearing. He's touching base before he has to check his cell. Committee rules."

Apparently, they didn't allow phones into chambers, probably as a security measure. Or maybe Congress had a sense of decency and decorum.

"The hearing starts in a few minutes," Kate went on. "They got all the files last night."

"I know."

Lucinda tried to get away, but the voice struck fast. "Let me talk to her, Kate."

Kate held out the cell-pic. Lucinda slowly turned, seeing Pavel on the little screen, with what looked like Dreher's shoulder behind him. "Peale," he said, "make sure the synesthesia volunteers know we have no interest in altering their condition."

"They know. It's on the release forms."

"Remind them."

Pavel was jerking her chain. Synesthetes rarely considered their condition a handicap, but while Lucinda had no interest in coercion, she realized a few might truly want a standard set of senses. Pavel had been all for giving subjects freedom of choice in previous areas—one of which had cost her dearly in the office power plays—but the winds blew him differently here.

"I'll continue to underscore it, Dr. Petrusky." She kept from snarling or snapping with the underlying thought, *Five hours.*

She handed back the phone, went to her office, and powered up her computer station. Before she could do anything more, Kate swung her door open.

"There's a TV set up in the conference room, Lucinda. The team's going to watch the hearing there."

"Oh." Lucinda sighed. "I've got some work I need to square away, Kate. I'll join you as soon as I can."

"It can't wait a couple hours?" But Kate was already backing out. With a shake of Lucinda's head, she disappeared.

Lucinda counted to five, then went to close the door. Gently, she turned the lock. Back at her desk, she started her word processor program, put in a disk, and called up her resignation letter for a last look. It was fine: a few simple sentences, without invective. That would come later, on both sides.

Next, she studied the statement she'd be giving at noon with Sam. She noted a couple of possible revisions on the screen of a pad, and tried to think them over. Her eyes kept being drawn to the clock in the corner. Four minutes of seven; four of ten in Washington.

Lucinda shrugged. She turned on her secondary monitor, went to C-SPAN's site, and called up the web simulcast. She might not be part of the pack, but she was still curious.

The camera was panning across a large room, paneled in dark red wood. The angle went from a nearly full public seating area, across long tables festooned with mics and small consoles,

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to the double arc of desks, already half-filled by Congresspersons, and backed by portraits on the wall. The caption at the bottom identified it as the House Science Committee's hearing room.

As a mellow-voiced announcer told Lucinda more things she already knew, she drifted back to her pad for a couple of minutes. She only looked back when there was movement. There they were, entering the hearing room, led by an anonymous staffer. Pavel was in the lead, and took the middle seat at the nearer table.

Someone came up to shake Pavel's hand and exchange a few words. By the time the announcer identified him, he was headed away, toward the arcs where the Representatives sat. Lucinda was unsurprised. Pavel had minted myriad such connections. However many he had cashed in to arrange this hearing, he had plenty more.

Just past the hour, the image switched to the Chairwoman's seat at the top arc. The camera caught an inscription in the wall above her head—"Where there is no vision, the people will perish"—before zooming in on her. She formally opened the session, and rattled off introductory remarks. She then introduced the other committee members, who made their own remarks. Lucinda made herself listen, but was nearly lulled to sleep before the chair introduced Dr. Urowsky.

Leonard burned some of his time explaining the mechanics of neural overlay to the committee, needing that time to find a rhythm. Two banks of emitters set into the desktop created a light interference pattern, so his scripted statement unfolded before him in the thin air. He needed time to fine-tune his use of the scrolling controls, but soon was reading steadily.

"... has already proven its great therapeutic worth, through the nearly two hundred patients treated by our program alone," Urowsky said. "All it needs is some salutary oversight, to prevent a patchwork of ethical guidelines in various states from sowing confusion. The AMA is currently working on developing such a framework. If Congress feels it must act in the matter, I urge it to study that framework, and ..."

Too bad. Leonard had been doing okay until then. The AMA board had flailed about for nearly a year without producing this framework. Leonard's appeal for patience and restraint was lame, and he probably knew it. At least it showed he still had ideas independent of Pavel.

Urowsky went on in similar veins. One long camera angle showed Pavel, his body taut, one foot twitching with impatience. He didn't need to wait long. Once attention was on him, he was the image of calm and intelligence, and he was in his stride within seconds. He didn't even need his ghostly prompter.

"The greatest proof of the value of overlay is in how much it has accomplished despite wholly adverse circumstances. Research is scattered across half a dozen universities; oversight is disjointed and weak; worst, there is no overall mandate for what overlay can and should provide to humankind. We can continue to function in this environment, but a rationalized system would unleash us to make far swifter and broader gains."

Lucinda split her pad screen, so she could take notes on Pavel while still having her speech in view, to adjust her words to rebut his. And he had plenty of words.

Pavel was proposing a national overlay study center, to conduct research and coordinate the efforts of subsidiary labs—meaning everyone else. All researchers and practitioners would submit to its oversight. That oversight would come from an advisory board, ideally appointed, he said, from the ranks of those most experienced in the field, the research scientists themselves.

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It was what Lucinda had expected. Heavy-handed as it was, the scheme might work, with the right people. If Pavel picked those people, starting with himself, she saw disaster.

Her attention snapped back from her note-taking. ". . . pool of brain templates, from which we pick the best matches of physical structure for our overlays, must be rescreened. Anecdotal reports of stray ideas, opinions, and memories being transmitted to template recipients, while still unsubstantiated, indicate a potential failure point. In correcting the original pathologies, we might possibly sow the seeds of new ills."

Lucinda remembered when Pavel put no stock in those anecdotes. A good scientist would change his mind with the facts, but the timing of Pavel's change was certainly convenient, for him.

"The greatest threat here is not from familiar mental disorders or violent tendencies. It arises from the less recognized diseases of political, evangelical, and cultural extremism, whose kernels can more easily lie undetected, but are just as destructive to modern society. I am speaking of hate: legally culpable hate."

Lucinda almost dropped her pad. The stakes had just gone way up.

"Hate crimes are a stain on American society. The underlying prejudices that inspire them are stains on the mind. Combating this scourge is now crucial, not only for its own sake, but to ensure that its evil does not reproduce itself, unseen and unknown, by being imprinted into minds we mean to heal."

Well, he had a new target, one that might encompass an older one. Cast a wide enough definition of "hate crime," and you could catch a lot of people: for example, her. It might be his way, incidentally or not, of purging her from the program.

Too bad she'd beat him to it.

"We must scrutinize existing files, and we must closely screen new template pattern donors, by background check and under brain scan, for these aberrations, to ensure our donors are of sound and trustworthy mind."

Lucinda nodded sadly. She centered the paragraph she had been mulling.

Overlay is drifting toward becoming a political tool. The solution to that is not to put control in the hands of a political body.

Out came "drifting;" in went "being driven." She scrolled downward, adding the more forceful words and phrases she had been hoarding. She had held herself back, out of a persistent professional respect, and a remembrance of what once had been friendship. That was past now. She was making Pavel her open foe, and she had to go all out, as Sam had urged, to win this contest.

"But this is only a stopgap, until we end our tolerance of extremist hate, treat it the way we treat the more explicit violence in our society, and remove this lurking risk from our work. I call upon Congress to give full support to a program of research to identify the root patterns of hate mentalities. Only then can neural overlay be free from menace and fear."

It might even be too late now, whatever words Lucinda used. She had given Pavel the first move, and he played politics like a chess master. He could lock up the committee, maybe even the whole Congress, if his zeal swept them up. And right now he was—

Saying nothing. Had she missed the rest of his statement, lost in her own thoughts? She looked up, cursing softly.

The camera was swinging, blurring the picture. There was a murmur, loud and rising. She could hear the scrapes of chairs. The camera stopped at the top arc, where one man in a security uniform was pulling on the arm of the nonplussed chairwoman, while a sec-

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ond pointed to a side door.

The camera wheeled again. Before it reached the gallery, with people jostling in the aisles to reach the main door, she caught a flashing glimpse of incomprehension and alarm on three familiar faces.

Lucinda caught the mood, confused and a little panicky. "What's happe—"

The picture cut to a glass-walled studio. A man, the host of C-SPAN's call-in show, was at the glass, pointing. Someone shouted "Move!" off-screen, and he did.

The camera zoomed, catching the airship as it fell from an overcast sky. The gondola was smashed and smoking. Rips in the skin fabric widened as air tore at them. One antenna came away, tumbling to earth.

The ship was a fixture in Washington's sky, a sensor and security platform. Now it was a wreck, crashing somewhere well north of the Mall.

"It came from the west," the studio host said, voice cracking.

"What did?" Lucinda said, her voice cracking too.

"What's that?" The camera slewed left, past the Washington Monument. Somewhere beyond the Lincoln Memorial, there were two dots low in the air.

The picture cut out, and Lucinda's breath caught. When it returned a second later, it showed a new, lower angle on the crashing airship, as its tail caught the corner of a large building.

"—the convention center," said some woman. Only now did Lucinda see the "LIVE—WJLA 7" logo. C-SPAN must have picked up a local feed, a reporter and camera on one of the lawns of tourist Washington. "The missile came from west of us, maybe from the Watergate—and now there are—"

The camera caught the same dots, now with visible short-winged silhouettes. One was banking toward the Lincoln Memorial, the other flying nearly head-on to the camera. There were shouts, and a scream, drowning out the distant buzz.

"—small airplanes, maybe drones. Cruise missiles? No, they're banking around, not crashing, but this can't be coincidence."

Flames tore across the sky, above one of the planes. The camera followed it for a second until it self-destructed, then followed the thin smoke trail back to the roof of an ornate building just as the "whoosh" reached them.

"—Old Executive Office, the missile launcher on the roof. Now I can see next door, the White House, people running across the roof, carrying weapons. I don't think they have a clean shot. The planes are—what's that? Smoke?"

There was a rattle at the doorknob, then a pounding. "Luci!"

"I'm watching it, Sam!"

Back on the screen, one of the planes had left a white puff in its wake near the Reflecting Pool. "Gas?" said an off-screen voice, probably the cameraman. "Spores? Oh, jeez!"

"An unknown substance," the reporter said, "emitted by—there's another cloud—"

The camera had gone low to follow the drone. There were now panicked tourists running through the shot, racing like Lucinda's heart. It had been almost a year since the last one of these, and that had just happened, the dust settling before the first camera caught anything. Now—

"More!" The cameraman swung around, catching more dots beyond the Capitol. Figures on the Capitol roof shouldered bulky boxes, but did no more.

"—want to shoot, but I think they're screened, the drones flying just behind the House Office Buildings."

Ice jabbed into Lucinda's heart. Her colleagues were right in the heart of this. Leonard, Vera, and yes, Pavel.

A lance of light shot from one of the

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gunners. A drone erupted and fell, the laser staying on it all the way down.

"They got one! And this way, another one's going down." The camera got it just as it fell into the Potomac. "The defenses are working, but now I see more in the south—wait, those are ours!"

A flight of three arrowheaded war-drones split apart. One went for the drone still buzzing the Lincoln Memorial, one for the drones around the Capitol. One kept going straight north.

The camera swung ahead of its path, wobbled, and fixed on a plane swooping into a hard climb. Perspective was deceptive, but it looked like a small private jet a couple miles away.

"—musta been flying rooftop height," the cameraman said.

"A new plane, a bigger one, part of the attack, we assume—"

Laser fire from the war-drone caught its tail. The plane shuddered, and its climb flattened. The missile pedestal at the Old Executive building fired a volley, and the first missile caught it on the nose.

An image hung in Lucinda's mind from the instant before, a wisp of cloud passing in front of the plane, almost beautiful. It clung there because there were no more images to take its place. The feed had cut out again, and the frame stayed blank. She heard angry shouts down the hall; so it wasn't just her.

She tried to reload, but her browser couldn't find the page. She tried C-SPAN's homepage, with the same effect. Remembering the call letters, she tried WJLA's website, and got a cached page that didn't mention the attacks, and wouldn't show the webcast.

"What the—" Had the government cut off the live news? She'd heard once there were shadowy plans for that, in emergencies. She hadn't liked it then. Now, in this ghastly limbo, she detested it.

She swept out of her office to the conference room, to tell them what little she knew. A few steps from the door, she noticed the silence. Her brain spun into overdrive, thinking of all the possibilities she had been suppressing until now. It didn't stop her from walking in, didn't stop her mouth from saying what she had ready on her tongue.

"I can't get any news. What's—"

She saw their eyes, horrified and sunken, none of which left the screen. She saw Kate holding her cell-pic, forgotten, next to her ear. She knew instantly she didn't want to see what they did, but her legs carried her on inertia, and her eyes turned, by magnetism, to the TV.

Someone was standing with a camera in a parking lot, angle pointed slightly up to the bank of clouds that started several miles off. In the distance, maybe ten miles away, a pillar of smoke had thrust through, boiling upward, flashes of muted but still diabolical orange and red flaring in the huge mushroom cap that topped it.

The camera trembled, its holder's hands unsteady. "We're outside our studio, in Newington, Virginia." He choked on the next words. "Washington is gone."

II

Lucinda drove off-campus on Shattuck, skirting the town of Berkeley itself, dreading to see what might be happening there. She got onto the I-80 Autoway just south of Albany and activated the handoff to computer control. Only when she lifted her hands from the wheel did they start shivering again.

She and the others had watched for almost an hour. It was the same cycle, with little deviation: pieces of the drone attack; the jet carrying the Bomb; shots of the mushroom, now from two angles; footage of President Davis and Vice President Sanchez at

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the Cabinet meeting, before they were to have gone to Iowa to campaign for Monday's caucuses.

The one variation came when someone got a news-drone into the air. It showed smoke and flame, the stump of what was probably the Washington Monument—then the rising trail of a missile from a Humvee, and static.

That was when it became too much, and she and Sam left. And then Sam—

No, she wouldn't think about that. Nor would she think about what could have happened if she had confronted Pavel directly, not hatched some stratagem that let him and the others go off to Washington. No, she'd go mad if she went on . . . if she hadn't already.

She made herself think about Josh, for distraction. She reached for her purse, then realized her phone wasn't in it. She had left it in her office.

Lucinda wasn't going back there. She thought about driving on to Fairfield, where Josh worked, but decided to get back home, settle in, and call him from there. If the municipal building would let her call through, and if Josh was still there, and if—

Another car zoomed past, missing her side mirror by an inch. Traffic was sparse on 80, but much of what was there drove off automatic, very fast and none too steadily. People were panicking: no surprise. A black car came up behind, and Lucinda gripped the wheel tighter. This one passed smoothly, though, for all its speed, and she got a glimpse of opaque windows as it cruised by. Lucinda soon made her turn-off at Richmond. She could see the traffic downtown, nearly gridlocked around the supermarket, and detoured past it. She took side roads through eerily quiet residential areas, and turned onto her home street.

There was a black car parked in front of her house, one with opaque windows. As Lucinda stopped her car two houses down, she saw the business-suited woman leaving her front door and crossing the lawn. A man got out of the black car, and also approached.

She seized the wheel, shifted into reverse . . . then let her hands fall. These people didn't look explicitly threatening, and she couldn't immediately spot guns, but she could tell these were not people to mess with. Not today.

The woman arrived at her window, rapping on it. "Dr. Lucinda Peale?" Lucinda looked at her and nodded. The woman checked a handpad, confirming something. "We need you to come with us, now."

Lucinda didn't understand, and it didn't matter. Almost without willing it, she unlatched her belt and opened the door.

The black car sped out of town. Lucinda sat in the back, under the woman's gaze, unmoving. She paid no attention to the outside for several miles, except for the subliminal sense of going north, then east. Her mind quietly put the two together, and she looked out the tinted window long enough to confirm it, spying a sign showing the distance to Buchanan Field.

They arrived at the airfield and dashed into the terminal. The woman kept a firm grip on Lucinda's collar, half protecting, half steering. The man ran interference, clearing the way past officials with shouts and a badge. Their passage roiled the already agitated knots of passengers, whom Lucinda saw as blurs, milling around timetable boards with right columns all in red, and around TV screens she refused to look at.

They went through a door and onto the tarmac, near a small jet with dark-suited men at the bottom of the gangway. They climbed in, and the stairs began rolling away almost before they were inside. The male agent turned to the cockpit. "Have we got clearance?"

"For now. The airspace is shutting

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down. They might decide—"

Lucinda could hear no more. She was being hustled back, past more agents sitting with phones and computers, through a thin partition—and into the rear section where Nancy LaPierre and Kate Barber were already sitting. They didn't look nearly as surprised as she felt.

Kate had her cell-pic out, hitting redial, just as she had most of that awful hour in the conference room. The escorting agent made her put it away, then strapped Lucinda into her seat. The plane was moving before she finished. Within two minutes, the plane was taking off.

They shot upward, hard and fast. Nancy moaned, holding a hand to her stomach, but kept control. After a few minutes, their ascent angle moderated.

"Lomax, can I see you?" said someone on the other side of the partition. The female agent unbuckled herself and went forward, up a still-tilting deck.

Across the aisle from Lucinda, Kate pulled out her cell-pic again. "Kate," Lucinda hissed, but she redialed without heeding. "Who can you be calling?"

"Pavel, of course," Kate said, giving her a quick and unsteady glance. "I have to know if he's all right. He won't—won't pick up, and—"

Lucinda reached across the aisle, grabbing the phone in her hand. "Kate!" Kate looked back, her eyes wide and bright, her mouth twitching at the corners.

Lucinda drew a long, shaking breath. "Remember, Kate? They took his phone before he went into the committee room. He wouldn't have it even—he just doesn't have it. All right?"

Kate's stare held, but the wildness faded out of it. "You're right," she said. Lomax chose that moment to reappear, snatch the cell-pic away, and go back forward. Kate nearly lost control, settling back into her seat and trembling.

Nancy, behind Kate's seat, caught Lucinda's eye. She mouthed "Thanks." Lucinda just nodded.

There was low talking ahead. Lucinda listened, catching only pieces. She made out "yield estimate" and "recovery teams," then nothing for a while. "Anything on the shooter?" she heard, but the reply eluded her.

She gave it up, and turned back to Nancy. "Why did they take you? Us?"

"They never said. They came right into the lab—minutes after you and Sam left—and took us away. I think they left someone behind with Julio." That was their other grad student. "No explanations."

"And I asked," Kate added. "Plenty." She paused a moment, as the plane leveled off. "Well, they're going to answer now," she said, unbuckling herself, "and if they don't, I—"

"You'll what, Kate?" said Nancy. "March into the cockpit and order the pilot to turn around? They'll . . ." She couldn't bring herself to say how that would end.

Kate shook her head. "I'm going."

"No," Lucinda said. "*We* are. That's the only way to do this."

Her hand had just reached the buckle when a man came through the partition. He was black, young, his face very handsome but also very hard. He turned to Kate. "Please sit down, Ms. Barber." Disarmed, Kate obeyed.

He looked at the others in turn. "Dr. Peale, I presume. Dr. LaPierre. I'm Morris Hope, NSA." He produced no card, but nobody doubted him. "I'm deeply sorry for your losses today. I'm also sorry for our abruptness in collecting you, but these are extraordinary circumstances, and minutes may be vital."

"Vital for what?" Lucinda asked.

"For discovering who destroyed Washington."

Lucinda absorbed this. It was the only answer that made sense, but it still answered nothing. "You have sus-

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pects? People in custody?"

"Not yet, Doctor. Maybe soon, but we cannot wait for a capture to start bringing in specialists. We'll need to extract information from them very fast—so America can respond fast." The last words struck Lucinda like the toll of a huge bell.

"We can perform lie detection scans," Kate said, "but it isn't really our specialty. There are people closer to the scene—"

"We know all about the Penn State method," Hope said, "and we've got people trained in it. It's only relevant, though, if your subject is answering questions. If he's not, we have to make him want to answer. We have to change his mind."

Finally it was clear to Lucinda, but she got no leisure to consider it. "And I guess torture's not fast enough for you?" Nancy sneered.

Hope took the blow stoically. "There is no current interrogation method—not drugs, not psychological pressure, and not physical torture—that guarantees full or reliable results in anything less than weeks. We don't have weeks. We may not have days."

In the silence that followed, Lucinda finally collected her thoughts. "Why us?" she asked him. "Johns Hopkins is far closer."

"I know, and someone's going there, if I actually got someone to listen to me. But I was out here, so I gathered who I could."

"Here?" repeated Nancy. "Doing what? Spying on us?"

"No! My team was in S—in the area on assignment. I was watching C-SPAN in my room when everything went down. That kinda put you people in mind."

"And did you get the whole team?" Lucinda asked. "Did you find Sam Jeong?"

"Still looking, last I heard," Hope said.

"Find him, please." Lucinda got a puzzled look from Nancy. She told her nothing: nothing about what Sam had gone to do, how she hadn't had the nerve to stop him. Or join him. "He can help us," she told Hope, to cover up those thoughts.

Kate shook her head pensively. "We've never done something like this before, you understand."

"And we won't now," Nancy said. "You can turn this plane around now, Mr. Hope. We're not going to cooperate."

Kate flared. "Speak for yourself! When did you become boss?"

"Two hours ago. I'm senior surviving member of the team, Ms. Barber, and—"

"You don't know that!"

"Of course we know. Tell her," she said to Hope. He put his arms behind his back, his face a perfect blank.

"Besides, you don't have seniority," Kate said, her voice still cracking. "Lucinda was with the program before either of us."

"And you know why she isn't in the chain of command. She accepts that; so should you."

"I don't," Lucinda snapped. Nancy took it like a slap. "Sam and I were going to quit the team today, at noon, before that became irrelevant." There was a curious relief in finally saying it, but just a little.

Nancy stared at Lucinda for a second, then turned away, toward Morris Hope. "I won't go into the medical ethics of what you're proposing, Mister. I will tell you I won't lend myself to the bloody-minded pursuit of a scapegoat. I will not feed a cycle of violence that will only kill, and kill again, until nobody is left to die."

"Some people don't need a cycle to—"

Hope hushed Kate with the slightest move of his hand. "I can handle this, ma'am." He met Nancy's eyes. "Do you have more?"

"Plenty. I'm sure you don't want to

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hear it."

"Fine." He stepped down the aisle, looming over her. "I don't want scapegoats, Doctor: I want the guilty parties, and I want it incontrovertible that they're guilty. I know my history. If we strike back at the perpetrators, and then the slightest doubt creeps in about what they did, it will paralyze this country. It will make us afraid to defend ourselves, probably long enough for us to be destroyed.

"I don't know what the President . . ." Briefly, he closed his eyes and murmured to himself. ". . . will do, though I'd have strong recommendations, if he'd listen. I do know it must be fast, decisive, and sure. For that, he should have certainties to go on, not probabilities." He looked around. "You can give me certainties. I'll let you think that over."

He stopped at the threshold of the partition. "By the way, we're not turning around. And if you do try getting into the cockpit, we'll stop you."

"How?" Nancy said, her fires somewhat banked. "Shoot us?"

Hope gave an incongruously friendly smile. "Guns are a bad idea in a pressurized cabin. And we wouldn't need them." He left.

Lucinda barely had a second before Kate and Nancy began making their appeals. "Don't . . . start," she told them, and they subsided. "I have a lot of thinking to do, in peace. If either of you tries talking me around again, I'll go the other way. Got it?" Two aggravated nods gave their answers.

She sank into the seat, her head hanging to one side, letting her look out the window. It was the first time she saw the fighters, two of them, flying in escort formation. She shut the blind and closed her eyes.

Was what Hope wanted even possible? Anyone knowingly involved in this heinous act had to be utterly convinced of the political idea that America deserved it. And reversing political convictions was a problem. They were too diffuse, not confined to exact areas of the brain. One could pinpoint them, but overlaying them with closely matched areas of another's brain to reverse their content would be very hard.

Lucinda worked to recall cerebral patterns they had studied in years past. Was there an underlying similarity to structures of political thought they had missed? Probably not. Pavel had worked hard to uncover one, and he would have trumpeted it if he had even gotten close. If he hadn't found one in months and years, how could she succeed in days, or hours, separated from all their equipment and data?

They could work by brute force, imposing wholesale changes on the subject brain, but that would threaten to wipe out the knowledge they hoped to extract. It would be disturbing enough if it worked, the subject's memories and identity scrambled or effaced. If it was all for naught . . . could her conscience bear that?

Her eyes opened. Conscience.

It wasn't enough to have extreme views that theoretically justified mass murder. You needed a particular mindset permitting you to participate. Lucinda had seen plenty of examples over the years. She knew the pattern.

The basic theory was thirty years old, dating back to Fried's Syndrome E paper. Bursts of overactivity in the orbito-frontal and medial prefrontal cortices produced feedback that inhibited the amygdala. That blocked consciousness of emotion, allowing monstrous action without remorse. Afterward, the prefrontal cortex would fall into underarousal, precluding self-reflection, letting one avoid acknowledgment of the horror of one's deeds.

"Of course," Lucinda told herself. Anyone closely involved with the plot would have that defective neural architecture, maybe stronger than she'd seen in all the murderers and pe-

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dophiles who had gone through the lab. They could attack that structure. They could do it.

Now, should they?

"Of course what?" Kate asked.

Before Lucinda could wave her off, a commotion began up front. They heard mutters of horror and disgust, and Morris Hope swearing like an urban gang member, complete with traces of inner-city accent.

"God, what now?" Kate said. She stayed in her seat, but Lucinda got up. She raised a fist to knock at the partition door, looked at it as though it were something ludicrous, then knocked anyway.

It got quiet up front. "No keeping secrets in these quarters, is there?" Lomax said.

Hope opened the door, wearing a scowl that sent a shock through Lucinda. "Salted," he spat.

"What?" Nancy and Kate said. Lucinda, through bizarre association, thought he meant peanuts.

"The bomb was salted. Sampling drones confirmed cobalt-60, zinc-65, maybe others. The fallout's gonna be a mother." He stopped there, this time. "They really thought of everything. Fu—argh, stinking geniuses."

Nancy, horrified by the salting news, was suddenly doubly so. "How can you say that about these monsters, calling them geniuses?"

"Intelligence doesn't guarantee moral goodness, Doctor." Hope spoke with forced mildness, and let the words hang for a second. "It does seem to guarantee good planning."

"Good?" said Kate. "Why attack a city with drones filled with gas or germs or what-have-you when you're going to nuke it a minute later?"

"Diversion," Hope said sharply. "All diversion. The rocket that took out the sensor aerostat came from the southwest, fixing attention there. Then came the drones from west and southeast, splitting that attention. They probably had nothing but smoke aboard, but they spread confusion, and kept attention away from the northeast. The plane out of College Park Airport must've been noticed flying at rooftop level, but word didn't filter into the command and control loop until it was too late. Of course, the bomb probably had a dead-man's switch, going off right when that SAM hit it, but at least we might have limited the damage if we'd caught them earlier, set it off lower to shrink the blast radius.

"And the timing." He grunted, but lost none of his impetus. "All the commuters are in the city; the West Coast is awake; the attack unfolds just slow enough to give millions of people time to tune in and watch the big ending live. And it comes just before an election. Yeah, they knew exactly what they were doing."

His discourse had put Lucinda's stomach into knots, more than before. "You sound very knowledgeable, Mr. Hope," she said. Morris gave a hesitant nod, no more. "Who do you think—?"

The scowl returned. "I'm thinking the QT's, but they couldn't build an atomic bomb, not one this powerful, not alone. That means a government produced it, and who couldn't that be? Iran, Pakistan, China . . ." He hesitated, but he was too far in to stop. "Maybe the ex-Israeli arsenal, Russia, Korea, Brazil, or Egypt if they've really got 'em—any nuke power except us and Britain, maybe Japan."

"You don't need us after all," Nancy said archly, "if you're convinced al-Qaeda al-Taeni is guilty."

"I'm *not* convinced," he shot back. "Even if I were, it's not me who matters. I've gone through this before." He advanced a step on Nancy. "But whoever did it, did all they could to kill, destroy, contaminate, terrorize. Yes, Dr. LaPierre, they're smart. Maybe smart enough to get away with this." His look took in Lucinda. "That means

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they'll have the chance to do it again."

Lucinda felt her face burn. Nancy's dark face didn't flush, but her expression showed similar reactions that she strove to master. "Mr. Hope, I have a husband back in California who hasn't been able to reach me the last couple hours, and must be worried out of his mind. I need to speak to him, tell him I'm well. Can you arrange that?"

Hope's face went from sympathy to suspicion. "I'm sorry, I can't permit that."

"Can't? You mean you're going to cut us off from the world if we don't cooperate?"

"What about my daughter?" Kate added. "She's just in sixth grade."

"I can't let any of you call out. It's a matter of security, not punishment." He ignored Nancy's snort. "We can contact your families, give them some explanation of the circumstances. That's all we can do."

"What about a computer," said Kate, "or a television? Something to let us know what's happening in the world right now."

Hope grimaced. "We'll consider that. Dr. Peale?"

Lucinda started. "Huh?"

"Is there anyone at home you need me to contact?"

She thought of Josh—then of her two workmates, just feet away, listening to every word. She wavered, then latched onto something else. "My dog, Ben, is locked up in the house. Nobody knows I'm gone. He's getting up in years . . . don't know how long he can manage alone . . . oh, it sounds so stupid, fretting over him when . . ."

Hope laid a hand on her trembling shoulder. "We'll manage something. He'll be okay." He slipped through the partition.

Lucinda recovered with only a moist sniff. She wasn't going to start crying now, of all times. She felt eyes on her, and looked over her shoulder at LaPierre.

"Don't let him take you in, Luci. He's a manipulator, playing good cop, bad cop with us."

"Stop it, Nancy," Kate snapped. "She said she didn't want us arguing with her." Her voice dropped. "But if *you* want to talk about—"

A sharp throat-clearing stopped her cold. Lucinda added a warning look, then turned her head toward the window and opened the blind. She watched the earth pass beneath, and tried to ignore the fighter escorts, as she thought.

She wanted these perpetrators, these murderers of historic proportion, found. She wanted things done to them she'd be ashamed to tell to anyone—even if a couple of hundred million Americans would approve. She had no problem whatever with putting them through forcible overlays. She knew the reaction was emotional, but she trusted it.

What she could not quite trust was the government, or specifically the current administration. Or its remnants.

Lucinda recalled fragments of news, shots of the Treasury Secretary's motorcade on the streets of Chicago. Someone must have known, or presumed, that he was next in line. He was . . . he was . . . such a cipher, she couldn't think of his name.

". . . anti-government extremists, diehard revanchists for Israel, even a treasonous military faction . . ."

She turned back toward Nancy. "Was I not clear?" she hissed. Nancy opened her mouth, then stepped back from the brink. "Thank you," Lucinda said, and leaned back to the window.

What was his name? She strained for minutes on end. Burrows? Barlow? No, Burleigh. Lewis Burleigh.

The Senate had let him squeak through confirmation a few months ago on a party-line vote, not from confidence in him, but from inability to find anything actually disqualifying. He

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was a party drone, a bloodless accountant. He wouldn't do much but go with the current of what was left of the Davis Administration.

She had no respect for them: misguided, power hungry, intermittently competent, preferring politics to statecraft. They didn't deserve to wield power. They didn't deserve a taste of *this* power. And they didn't deserve to have someone ride in and rescue them from this fiasco.

But there were over three hundred million other Americans. What did they deserve?

As she pondered that, she saw a new plane approaching, then another. Did they really need that many escorts? Then the original escorts peeled away, and the new fighters took their place. Just a changing of the guard, but that still pointed to someone thinking they were worth the trouble.

". . . irrational, insane to provoke us. They have what they wanted. We're out of the world."

"They must count North America as part of the world."

Lucinda unbuckled her seat belt and stood, glowering over them. Kate and Nancy both managed to look abashed, or at least worried about what she would do. She had to think about that for a moment.

"I'm going to the lavatory," she decided, "for exactly five minutes. Get it out of your systems."

They managed to hold their tongues until she shut the door on the closet-sized washroom. She made good use of the time, but by the fourth minute was reduced to periodically dashing cold water on her face and looking deep into the mirror. Still she waited, until five minutes to the second, before opening the door. It hadn't been enough.

"—won't bring them back to life, and I won't abet it. Our work is the antithesis of that attitude: we cure instead of punishing. Will you betray that?"

"Betray?" Kate sputtered. "You call that betrayal? Getting no justice for our friends, for all the dead, for our country is betrayal!"

"I'm so sorry to see you like this, choking on hatred. I'm sorry to see you fall in line with *them*." Nancy's voice grew softer still. "Pavel would never have approved."

"How, how can you tell me that?" Kate was choking now, on tears. "How can you throw—throw that in my—" She broke down completely.

Lucinda finally understood, and could scarcely believe it. Pavel had never seemed interested in women. Nor in men, either, even when that would have explained his particular vehemence during the incident that wrecked her standing in the project. Pavel and Kate? It didn't seem like him.

Unless it was one more political stratagem.

It was horrible to think that, now, but she couldn't unthink it. True or not, what luck that she hadn't tried to recruit Kate for the walkout.

Thinking of that led her to worry about Sam, and her mind spun off in new directions. She walked past Nancy and the sobbing Kate, took her seat, and began looking again at the choice before her.

She didn't realize how long she'd been thinking without a resolution until it registered that the wide, dark river the plane had just passed was the Mississippi. As she despaired of ever reaching a decision, Morris Hope came in again. He looked more depleted than before, save for the slim, dangerous smile.

"We got the shooter," he told them. Three blank expressions met him. "The rocket shooter," he said, "trying to flee through Virginia. Had him for hours, but it took this long to bring us into the loop."

"What?" said Kate. "How could they not tell you?"

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"Turf marking. Fear of error. I'd expect that from the CYA—er, the CIA, but anyway, we've got him. He should be taken . . . where we're going."

"And where is that?" asked Nancy.

Hope's face closed off. "A secure facility. Now, I have to have your final answers very soon. We've gotta know how many people we're taking through security. We can't wing that, not there, not today. So, ladies, I need—"

"Oh, drop the pretense of politeness," Nancy said. "You're giving us an order. I'm disobeying it."

Kate gave a quick, burning glance over her shoulder. "I'll help you, sir, any way I'm able."

Hope almost smiled. "Dr. Peale?" He waited. "Please?"

Lucinda could barely find words. "I have . . . reservations . . . and I don't understand the urgency. Why would you rather have a 'no' now than a 'yes' tomorrow? Why can't it wait even a couple of hours?"

"Doctor, you've had hours."

"I think you know what I mean." But her strong tone was a sham.

"Okay, I do."

"It makes me . . . leery." It wasn't a big problem with her; it merely touched the outer fringes of her greater distrust, the one it wouldn't help to share with him.

Hope stood for a minute, thinking, then stepped back into the forward compartment. Nothing happened for a while. Nancy leaned forward to whisper, "He can't answer you, Lucinda," but Lucinda didn't acknowledge her.

A moment later he returned, a television console in his arms, its electrical cord draped over one arm. Another agent was behind him, a Hispanic woman who got a dirty look from Nancy.

"This is programmed for feeds from the five networks," said Hope, "the big four cable news channels, the C-SPANs—but those are gone." He looked around the constricted space. "Where can we put this so all of you can watch?"

They had to set it on the aisle in front of the partition door, and snake the cord past Lucinda's feet to an outlet. In the confusion, the Hispanic agent slipped into the seat across from Nancy.

"You'll get thirty, forty minutes of this before we start our approach." Hope looked right at Lucinda. "I hope this helps you." He handed her the channel changer, and stepped gingerly over the set and through the door.

Lucinda hit the power button with a bitter-medicine quickness. A voice was reciting names, supplemented when the picture came in by photos and captions.

"—assistant director. Louis Pastorini, video technician. Marianne Porter, audio technician—someone I knew when we worked together in Chicago. Osvaldo Reyes—"

A casualty list, but not for the city or the government. The anchor was reading off network employees missing in Washington. Lucinda clicked the remote, before the urge to hurl it grew too strong.

The next network showed gridlock outside the New Jersey exit of the Lincoln Tunnel, then people packed cheek-by-jowl reading the departure board at Penn Station. The city was emptying, and it wasn't alone, as a shot of Los Angeles freeways proved. Residents and workers in dozens of cities thought theirs could be next.

The report returned to the studio—but it wasn't the news studio. The camera stayed tight on the lone anchor, but the background Lucinda could see was from a sports channel. Part of the same corporation, she recalled, and well outside New York.

"Looks like someone beat the rush," she muttered, and flipped ahead.

This channel was showing footage of overseas reactions, but when shots

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of a vigil in some European park gave way to cheering crowds in a poorer setting, they cut the video. "We'll return to that footage later," one anchor stammered, "but right now it's pretty raw." With a wince, Lucinda switched again.

The next channel showed a map, Washington offset to the left, showing wind vectors and fallout patterns. Some expert was explaining what the various colors in the fallout diagram meant. Another talked about how the wind was shifting, from northwest to southwest, creating a broader fan of contamination from Annapolis to Baltimore.

They both gave sheltering advice, and a switch to outside footage showed the reasons. Taped footage from Morningside, Maryland, shot through a window, showed thick salt-and-pepper flurries drifting out of the sky. A close-up showed several of them settling on the outer windowsill, lasting an instant before melting into inky droplets.

"Survivors of Hiroshima recalled a black rain after the atomic bomb," the anchor butted in. "In Maryland, black snow is falling."

None of them mentioned those isotopes Hope had named. Was that being kept secret, or had the networks just chalked up one more horror and moved on?

The footage shifted to residential areas inside D.C. Fire trucks fought a wall of flame, until their hoses went limp as water pressure died. Another shot showed the exodus, cars and pedestrians clogging a road as a fire engine and ambulance tried vainly to breast the flood.

The next shot was live. Through the smoke, they could see an armored vehicle firing shells into a brownstone, bringing down a wall. A bulldozer advanced on the wreckage.

"They're hoping this firebreak will stop the blaze, or at least give them time," said an off-camera reporter. "But it's maybe three blocks away, with the wind behind it now, and nobody here looks—"

A piercing horn cut him off. Someone shouted about radiation and moving out, and the feed cut out seconds later. Coverage went back to a scrambling studio. One co-anchor stumbled into a sidebar report.

"There are disturbing reports of major unrest at several college campuses, presumably over the attack in Washington. Conditions described as 'violent' and 'riotous' have been reported at the University of Michigan, Wisconsin-Madison, Texas A&M, California-Berkeley, and Cornell, among . . ."

Lucinda's gut, already knotted and cold, went to absolute zero. Riots at Berkeley. Her university. Where she had left Sam.

He had pulled out of the underground garage a few seconds ahead of her when they left the lab. When he stopped his car suddenly on the West Circle, she went to see what was the matter. His glare was murderous. She followed it to a knot of several dozen people across the way at Moffitt Library. She couldn't hear them, but she saw arms waving and pumping.

"Celebrating?" Sam breathed. "Can't believe it, those—"

"Sam, no." She shook her head, trying to shake it all away. "You don't know that."

"Don't I?" *His words staggered her. "I'm not taking it from them. Not today!" His car screeched off, the back wheel nicking Lucinda's shoe as he drove toward Moffitt.*

Lucinda hadn't followed him. She had been afraid: of estranging Sam, of getting caught in a mob, of Sam being wrong, of Sam being right. Of everything.

Now she saw what had grown from that first incident, as pictures from Berkeley filled the screen, looking like something from 1968. Lucinda turned

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to her workmates. "When did this start?"

"I don't know," said Nancy. "There may have been some small disturbances when we were strong-armed away."

"Oh, definitely 'disturbances,'" Kate said. "Over at Moffitt, and beyond. They didn't exactly sound funereal," she added, blatantly baiting Nancy.

Lucinda didn't notice. She got up, pushed the TV aside, and didn't bother knocking on the partition door. Her sudden appearance gave the agents on the other side a shock. "Did you know about the Berkeley riots?" she demanded the instant she spied Hope.

Two of the agents rose to expel her, one reaching for her hip. "Stand down," Hope said, and though they didn't back away, they stopped. "Yes, Dr. Peale, we did."

"Why didn't you tell us?"

"We needed time," he replied slowly, "for confirmation."

"Of what? The riots? You could have turned on a television!" Her mind began to register the several computers, one for every agent, all brimming with data of various forms. "No, that wasn't it, was it?"

Hope stepped into the aisle. "I'm sorry, ladies." Only then did Lucinda notice Kate and Nancy behind her. "Your colleague, Sam Jeong, was caught in the demonstrations. He's been taken to a hospital, but . . . he isn't expected to survive."

"No." Lucinda could barely say the word. "No." She recoiled, stumbled into the side of the television, and fell hard into her seat.

Immediately, one of the agents slammed the door. A second later, Hope opened it, gesturing sharply at whoever had shut it. He went to Lucinda, shoving the still-running TV aside with his foot. "Are you all right?"

All right? What could be all right? Sam was dying, and she had done nothing. Everyone was dying, or dead. Would she do nothing?

She reeled. Hope reached out to support her, letting go quickly once she had her balance back. Kate and Nancy were crowding in close, too.

Lucinda shut her eyes, summoning the remnants of concentration. When she opened them moments later, they went straight to Kate. "Kate, we have to get working. I think I have a viable methodology, but maybe you can spot any flaws in it.

"Mr. Hope, you'll have my cooperation interrogating your conspirator, but I have serious doubts about my personal ability to perform a neural overlay. I've observed several procedures, but the last was over a year ago. I've never placed a single electrode or stimulator myself, and this is a bad time for trial-and-error learning.

"Dr. LaPierre—" Odds were bad, but she had to try. "Nancy—"

LaPierre's face carried her answer in its defiance and revulsion. "No, *Doctor* Peale," she growled, but she hadn't needed to say a word.

Lucinda shook her head wearily. "She's out, obviously," she told Hope. "And I don't know whether Kate and I are enough."

"It's okay," Hope said. "We're working on it."

III

They raced across the tarmac: Lucinda, Kate, and a quartet of agents. Nobody had told her where they'd landed. "Grant County Airport" signs didn't help, but spotting the West Virginia plates on some utility trucks did.

"What about Nancy?" she said in a gasp to Hope. "Are they taking her back to California?"

Hope shook his head. "Nothing's flying that isn't absolutely vital, like you. Might put her on a train or bus, but those may not be running, either."

They came upon a trio of helicopters. Hope bundled Lucinda and

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Kate into the back of one; his fellow agents piled into the second. Lucinda noticed, while strapping in, the turrets and launchers on the third one.

The choppers shot into a dim, patchy sky. With their easting and the time in transit, dusk was approaching. From the sinking sun, Lucinda figured their course as northeast, following the Appalachians.

She and Kate continued to consult. Could they risk keeping the patient awake, to get him talking faster, as Hope suggested? Brain surgeries often happened with conscious patients, but it introduced variables during overlay, extra input streams while they were trying to lay down very specific patterns.

Could they imprint the new patterns faster? Maybe, but the gain in time would not be great. It would also risk lost precision, even possible injury to the subject's sense of identity. "I have no problem effacing the kind of personality that could do this," Kate said over the rotor noise, "assuming we've got the right man."

That thought had been nagging Lucinda, too. She reached across to get Hope's attention in his front seat. "How sure are you that the man in custody is the rocket shooter?"

Hope squinted, shook his head, and reached for a set of headphones. On his signal, Lucinda and Kate found and donned theirs, and found the activating buttons. Lucinda repeated herself. "I can show you the police video of the launch tube they found in his vehicle," he answered.

"He took it with him?"

"Guess he was worried about us getting fingerprints if he left it behind. We will get them, too, for whatever good that does. Turns out the car was stolen, though, so that dead-ended." He snorted. "More of their planning."

Lucinda thought a while about what to ask next. "Agent Hope."

"'Morris is okay."

She nodded mechanically. "The riots we saw on TV; the evacuations; the panic. That's what you're trying to forestall by moving so fast, right?"

Morris grimaced. "Yes and no. That's just the rash—symptoms, I mean. Thing is, in times of great threat, people need a way to feel safer. Either they need someone to protect them, or they have to protect themselves. It can even be psychological protection: take Churchill's speeches during the Blitz, backing up the RAF's work: "If people don't have that sense of protection, they become useless. Fast or slow, they fall apart. The bigger the threat, the worse it is, and the bigger the group, the more vicious-cycle feedback pushes things over the edge. If we as a country don't believe, soon, that we're no longer as vulnerable to another mega-terror attack, this nation will fall apart—or tear itself apart. That means apprehending, punishing, deterring."

"Does it mean we're going to wipe out the country responsible—if it is a country?" Morris tensed. "You can tell us. Dr. LaPierre's not here, and we won't back out now."

"I really can't say. I don't decide; I probably won't even get to advise. But . . ." His jaw made short, grinding motions. "There are about to be two groups in America: those wanting reprisal, and those wanting restraint. There are the America-haters, too—a little minority, at least here—but they fit in on the fringe of the restraint group. Both sides think that their way makes us more safe, and that the opposing way is dangerous and immoral. Give them long enough waiting before something is done or decided, and those groups will rip this country to pieces.

"So there has to be a resolution, soon. Now, if it's for reprisal—well, the restraint side sorta expects it. They're resigned to the violence in human nature. They'll be disappointed, not shocked. They won't revolt."

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"Their own restraint at work," Kate said.

Morris chuckled. "Not as much as you'd think, but let's leave the inner psychology out of it. The reprisalists, though, won't take a restrained response lying down. They'll find a way to lash out against the guilty. If we're lucky, that means a little ethnic or religious pogrom. If we're not, it means they go after the government that fiddled while D.C. burned.

"So yeah, we'd better slam them hard—which, granted, is what I'd say in the first place without all that analysis. It doesn't have to be nukes, but it does have to leave them in pieces." Morris turned back forward, his shoulders bowed, his head slowly sinking.

Lucinda reached a hand toward him. "You haven't been thinking about this just today," she said. "More like years."

The corner of his mouth twisted. "Twenty-two years, four months, and eight days." Lucinda didn't have to count backward to know. "I was gonna join the Marines or Army, but by the time I was of age, I could see how the wind was blowing. I took another career path."

"Looks like you made the right choice."

He looked back, his eyes suddenly sad. "I haven't accomplished anything yet." His voice was soft, but the tone made it unanswerable.

Lucinda tried to occupy herself by thinking about the work ahead, but there wasn't much more she could do that moment. Morris had said she'd have a link to the team's computers at their secret location, access to their brain pattern templates and the overlay-planning programs. Without them at hand, she could only plan the broadest strokes of their work. She had asked Morris to encourage whoever was on site to run some preliminary scans, but he didn't sound confident about the advice making an impact. Did they even have MEG scanners and TMS machines on site, wherever it was? If they didn't, all this was going to be for nothing.

"When did we turn around?"

Lucinda had to take off the headphones: Kate was speaking without them, leaning in close. "We haven't."

"We must have. We're going south now. I can see the sunset." She pointed out her right-side window, toward the orange glow suffusing through the clouds near the horizon.

Lucinda looked there, then snuck a peek at the light coming through her window. She swallowed. "Maybe we're doubling back," she said behind a cupped hand, "to keep the secret location secret."

Kate shrugged. Morris turned to say something, but Lucinda silently hushed him. She recalled Kate's earlier brittleness: she wasn't going to hazard its return. She kept a tense silence, taking scarcely any looks at the distant funeral pyre of Washington.

The helicopter pilot started talking a lot more. Lucinda looked outside into the twilight, assuming they were close to landing. She saw the added choppers first, circling in a patrol pattern, then one swinging over as an added escort. Moments later, the denuded trees below gave way on one hillside to clearings with low buildings, linked by snaky roads. The area showed few lights in the enfolding darkness, but plenty of vehicles crawled along the roads, and smaller motes milled around the buildings.

"We're about to land," Morris said unnecessarily. "Get out on my side. Do *not* leave me. Understood?" Lucinda and Kate both nodded.

They alighted on a corner of the nearest large clearing. Lucinda waited as Kate climbed out, then followed her. The first thing she noticed outside was two soldiers about twenty meters away, their large weapons leveled. That, it happened, was the lightly guarded side of the landing pad. She

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cleaved to Morris, close enough to step on his heel once.

They stopped near a building entrance, plastered with signs she couldn't read in the fading light. Morris spoke to a waiting officer, who then lifted a machine to the agent's head. A moment later, it spat out something that the officer gave to Hope. He then advanced on Lucinda.

"Ma'am, look directly into the lenses. Try to avoid blinking."

She knew this drill. She held her eyes open for the retina scan, took the card the machine produced, and waited as Kate, and then the agents, got the same treatment.

Morris led them into a building. Lucinda tried to read the signage outside the door, but in the haste and failing light, she could only catch disconnected words: "Weather," "Unauthorized," "Without Warning."

Inside were a pair of railcar bays, one occupied. Her group clambered into the car. Seconds later, the rest of Morris's agents joined them, along with two large soldiers. The car lurched and began running on its track, downward. Light was soon far behind, save for yellowish bulbs at long intervals in the tunnel.

Through all the disorientation, Lucinda remembered that she and Kate would be at work in a few minutes. She caught Morris's eye. "We're going to need to see your prisoner's scans immediately once we get where we're going. I assume your people have taken a proper baseline."

"I . . . don't know about that, Dr. Peale. They may not have been notified."

"Find out, and notify them now, if you can. Kate, if they don't have a baseline—"

"I'll handle it, Lucinda."

"Good. We'll also need access to our project files at Berkeley. That is, if our lab building hasn't been burned to the ground."

"They got uploaded a couple hours ago," Morris said.

"I'll need to review them right away. Hopefully, I'll be able to read them somewhere close to your interrogation room, and the surgery."

"We'll do what we can." Morris leaned away, tried his cell-phone, and snapped it shut with a grunt. He talked to his agents instead.

It was strange for Lucinda, talking business this way, playing boss after hours of helplessness. Maybe it was the shock finally wearing off, or maybe a new kind of mental barrier rising up.

The car rattled to a stop. They came out in a regimented jumble, toward a trio of electric carts. "This way, Doctor," someone said, with a tug on Lucinda's arm.

She found Lomax pulling her to the rightmost cart, as Morris took Kate to the left. She smothered an instant of clingy panic and got into the back seat, one of the guards stationing himself next to her.

Only when they were driving did Lucinda notice her surroundings. It was a small underground city, inside a cavern maybe fifteen meters high. Floodlights on the ceiling gave enough light to match an overcast day outside. Buildings two and three stories high were all around, and down one road they crossed, Lucinda was sure she saw an artificial pond, with a fountain gurgling away at its center. People were meant to live here, for a long time.

They stopped at the main door of one building, and Lomax bundled her out. Following the agent's example, she gave her card to the guard, who slipped it into a scanner and took another retina scan. They both passed.

They wound through halls and a stairwell until they came to a door with yet another guard, who stepped aside smartly. "I'll be outside if you need anything," Lomax said.

"Um . . . yes." Cut loose, Lucinda could do nothing but open the door.

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Inside, the room was half bare, with a bank of monitors and interfaces laid along the opposite wall. A small figure in a thin white coat, with thin white hair, sat at one of the monitors, unmoving. The door clacked shut behind Lucinda, and the figure turned with a start.

She knew him by sight, though they had never met. He was the lead neurosurgeon on Johns Hopkins's overlay research team. "Dr. O'Doul," she said, stepping toward him.

Edwin O'Doul's crinkled gray eyes peered. "They said they were bringing in others." The eyes narrowed further. "Do I know you?"

"Maybe by reputation. Dr. Lucinda Peale, California-Berkeley." She held out a hand.

"Oh." A flash of distaste crossed his face, but he did take the hand for a second. "You've come a long way." He blinked, and turned back to his monitor.

Peale took the seat next to him. "Me and one colleague. Are any of yours here?"

"What? Oh. Oh, no. I—they—they set off to Washington, to volunteer their medical services. I remained behind. I thought I should, to prepare our hospitals for the influx of cases. They'd be coming to us. We're Johns Hopkins, after all. But then the government people came and swept me away."

"Us, too. We're in this alike."

O'Doul made a soft sound, no more. Lucinda took a minute to figure out the interface, and another minute to get into the template files. While she was waiting, she looked over at the brain model projected in O'Doul's holotank. "How far have you gotten?" she said, hoping to draw him out that way.

He shook his head limply. "Not far. Not anywhere. How they expect us to rewire such deep-seated hatreds in a man is beyond me."

"Not hatreds. Conscience."

She spelled out the theory she had developed on the plane. A light began to show in O'Doul's eyes. "Of course," he said. "Use the animal levels of the brain to help reawaken the humanity of the human brain. Why didn't I see it?"

"It took me time, too."

"But you're right. We can—but will it be enough? Will the subject have ingrained opposition and refusal to help deep enough in his mind that it resists the flood of conscience by inertia?"

"There's one way to find out."

"Exactly! Here, this is what we have on him so far." He linked their stations, and the neural map in his tank appeared in hers. They came alive in tandem, colors shifting as the brain performed its myriad inner functions.

"There's the underarousal," she said half to herself. The expected portions of the frontal cortex were blue, the medial prefrontal cortex deepening toward violet as she watched. "Where's the context?"

"Here." A timeline appeared under the image, with a green dot inching rightward. Ticks on the line produced dialog boxes when she moved the cursor over them. "Who provided you with the stolen car?" was one; "Did you procure the rocket launcher yourself, or did someone give it to you?" was another. Someone must have recorded them as they were asked.

"Where do I bring up his answers?"

"They'd be on that line, but I don't think he's been answering them."

Lucinda ran the recording faster. With a few parameters drawn from the prisoner's scans, she ran a first compatibility check with the neural templates in their files, Berkeley's and Johns Hopkins's alike. It pared away about a third as unsuitable, leaving plenty, she hoped, for the more exacting comparisons to come.

"I suppose I should know," O'Doul said, out of nowhere. "You've had more recent exposure to the news, Dr.

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Peale. How bad is it really, outside, there?"

"I . . . I'm sorry, Doctor. We were kept alone in the back cabin of a plane during our trip." She regretted the half-truth, and hoped she wouldn't be telling more.

"I understand." He stared into the holotank. "I thought you might have heard something about Georgetown. Was there any—"

The opening door saved Lucinda, even though this time she would have been honest in her ignorance. Morris Hope came inside. "Lucinda; Dr. O'Doul," he said, seeing the elder doctor for the first time. "Barber is almost set up with the prisoner. You'll have live audio-visual feed access inside this room, along with real-time scans. Do you have any other requirements?"

O'Doul roused himself. "I assume everything will be recorded for later playback?"

"Absolutely." Once O'Doul nodded, Morris beckoned to Lucinda. She walked over, fearing she'd be finding out why he couldn't have just used the phone.

"We sent an agent to your house," he murmured, "like I promised. Your dog's fine. Turns out someone had come over to look after him, a man named Joshua Muntz. You know him, right?"

"Josh?" In her surprise, she finally managed a nod.

"Okay. I'll let you get back to work, Doctor."

He had the door halfway open before Lucinda touched his sleeve. "Thank you," she said. Morris nodded, and walked out briskly.

She found her way back to her seat. O'Doul looked her over skeptically. "Are you sure about that Josh person?"

Lucinda snapped back into focus. "Of course. He's a very good—" She sighed, and a smile crept onto her face. "He's someone who loves me."

He accepted that latest half-truth. It was enough for her now to say that much. "He's someone I love" could come later.

Her reverie ended when O'Doul made the connection to the examining room. A flat screen to Lucinda's side showed a figure inside an older model MEG. He was lying down, his face and torso hidden. Plastic chaining bound his wrists and ankles. Above one manacle was a device clamped around the leg.

"A shocker." O'Doul must have noticed it. "Hope they've got lots of spare battery packs."

It was the first angry word Lucinda had heard from him. Had they been using it on the prisoner already? Not during the interrogation, she thought: she would have seen clear signs of pain.

Kate walked into the margin of the picture, and stood in silence. The soft music they usually employed to relax a subject was missing. It was just Kate and the prisoner, and presumably guards off-screen.

"My name is Katherine Barber," she finally said. Lucinda took notice. Kate never used her full first name. "Will you tell me yours?"

Nothing. Kate filled the time by working a stylus across her pad.

"There are extremely grave charges laid against you. Do you understand them?"

Still nothing.

"You are accused of shooting down a security aerostat over Washington, facilitating a nuclear attack on the city. Do you confirm or deny that you did this?"

He said nothing. His brain yielded a bit more. Lucinda watched his medial prefrontal cortex creep deeper into the blue. Kate's questions became more specific, but his silence remained as complete.

"Looks like he's enjoying himself," O'Doul said. Lucinda thought he was reading far too much into the tenacious passivity.

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Kate went on without result, until she walked out of shot in quiet frustration. Lucinda looked for camera controls, but before she found anything, Kate was back in the edge of the screen.

"Maybe you were fleeing from the scene too fast to see how powerful that bomb was. The news is estimating seventy-five kilotons, but I've heard higher numbers here, ninety or one hundred. Hiroshima was destroyed with a twelve-kiloton weapon."

Kate began striding closer. "You do know, don't you, that your bomb didn't just destroy a few national landmarks? It killed other human beings, tens of thousands of them, maybe hundreds. It crushed them under rubble, roasted them alive when it didn't just vaporize them, or showered them with radiation so their bodily functions are falling apart, this moment, from the inside out, until—"

Kate's voice, already cracking, gave out altogether. But then why were her lips still moving, her hands chopping at the air?

Lucinda saw O'Doul's hand on the volume switch, now turned off. His other hand was over his face, tense and trembling. She couldn't bring herself to turn the switch back. She spotted an earpiece, plugged it in at her console, and got the sound back for herself alone.

"—blowing across Maryland, poisoning it with those salted isotopes."

Kate had grown shriller still. Lucinda moved to dial down the volume, before something in the holotank caught her eye. She forgot Kate.

"Dr. O'Doul. Edwin!"

O'Doul raised his head, and Lucinda pointed at his tank. The frontal areas were indigo now, but her finger indicated the limbic system, and the cingulate cortex brightening into orange.

Raw eyes met hers. "I know. What did you think I meant?" Before Lucinda could fashion a reply, he braced himself and turned up the sound.

"—from your action." Kate was hoarse and phlegmy. "People you knew; people you liked—the way I lost people I knew. Colleagues. Friends. A man I loved." Her voice shattering with the last words, she turned away, close to sobbing.

In the holotank, the cingulate cortex peaked at a dull red. Lucinda double-checked the most active neurons. They were indeed dopamine producers. Kate's litany of horrors, and her breakdown, had brought the prisoner a strong surge of pleasure.

There was a whimper. Lucinda was never sure whether it was Kate's, O'Doul's, or hers. Kate was looking at her own monitor now, seeing what they did, realizing what they had. She looked around her, grabbed and hefted some hard object, but after only one step toward the prisoner, let it crash to the floor. She left the shot again, leaving no doubt she wouldn't be back.

"We've got more work ahead than we thought," Lucinda said, not trusting her voice past a whisper. "Let's find the best matches." She started putting together two sets of pattern recognition parameters, one for the frontal structures and one for the cingulate cortex.

They outlined specific neural pathways and structures, the ones responsible for the prisoner's most important reactions and affects. They ended up using two pattern recognition routines, hers linked up from Berkeley, his from Johns Hopkins. Both finished in less than ten minutes. Their short lists mostly overlapped, giving four matches for the frontal cortices and three for the cingulate cortex. No brain template was on both lists.

Lucinda frowned. "Have you ever done an overlay using two separate templates?"

"No," said O'Doul, "but it won't raise problems if the two areas aren't connected. That means damping

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dopamine production at the cingulate source, rather than cutting off their effects in the frontal lobe. I had intended that anyway. We don't need all that dopamine floating around."

"Certainly not. Still, I think the frontal lobe should be our priority. We'll get the best match we can there, then pick the cingulate structure that meshes best with it."

"I concur."

They both shuffled through the scans, to find their matches. Lucinda felt an odd sensation creep over her as she examined the frontal structures. *Someone's walking on my grave,* she thought, before realizing she couldn't have made a worse comparison at that moment.

"Hm. Mislabeled."

"Come again?" Lucinda said.

"This scan," O'Doul responded. "I assume you took it, but it lists you as the subject."

"ID doesn't matter in—" She suddenly knew why something had seemed familiar. "Actually, I did provide a template for our research. Me and Pavel," she said, trailing away.

"So this is yours?"

"Yes. It's me." Her mind began churning. "It has to be me."

"If you say so. Now, out of these templates, I—"

"No, Doctor," said Lucinda. "I meant we have to use mine."

O'Doul gave her a guarded look. "I was going to say, Dr. Peale, that the third template appeared best suited."

"Under any other circumstances, I'd probably agree. Right here and now, though, my template has an advantage the others can't touch."

"And what can that be?"

She pulled herself straight. "Me, here."

"Are you certain, Lucinda?" Kate still sounded froggy, and her eyes were painfully red.

"It's our best chance to produce a successful overlay," Lucinda said, walking past Kate into the scanning room. One of the guards followed them inside, the other closing the door behind them.

"Are you sure it's not becoming personal?"

Lucinda wheeled on her. Kate's expression was stern and adamant, but she soon began to color. "It's personal for all of us," Lucinda said, "but look at it outside all that. Will this give us greater precision in attacking the specific attitudes we need to erase, or won't it?"

Kate's jaw ground tightly. She finally shifted her eyes. "All right. Get in."

Lucinda didn't wait for a less grudging invitation. She laid herself on the examination bed. It felt warm, but still gave her a chill to think of who was lying there moments before. Now he was being prepped for surgery. O'Doul was still upstairs, observing, recording, preparing his overlay template.

Kate set the restraints for Lucinda's head and upper body, then went to the control panel. The bed slid into the scanning tube with a slow grind. New equipment apparently didn't get into this complex very often. She made herself not think about what that could mean for the overlay procedure.

The bed stopped and locked. Suddenly, it was very quiet. Lucinda tried to keep her mind clear, unperturbed by the emotions under the surface. She started reciting the Greek alphabet, forward and backward, an old calming technique she hadn't used for years.

"Dr. O'Doul's messaging," Kate said. "He says to stop thinking in Spanish: it could confound the baseline with signals from the language centers."

Spanish? Lucinda almost laughed. Having O'Doul misled by her looks was a comfort of sorts. If magnetoencephalographic scans were the key to "mind-reading," as some thought and feared, scientists didn't quite have the knack yet.

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Things got quiet again for a minute. Just as Lucinda got used to the calm, Kate began talking. Her words came slower than with the prisoner, and no longer had the personal, accusing tone and content. Mainly, they were still the same words, the same recitation of terror, destruction, death, and despair. It ended this time with "People we knew, people we liked." The same colleagues; the same friends; then the admission from Kate that Lucinda could not match.

It was over sooner than Lucinda had expected. She could have borne no more of it. The emotions she had held down in the observing room broke through here, where metal and plastic shielded her from view. Tears flowed, and she could not stop them, or even move a hand to wipe her eyes.

The bed began pulling out. She made a supreme effort of will to staunch the tears, and only made herself heave with a sob. She couldn't even turn her head or cover her face. She screwed her eyes shut, the only thing she could do.

She felt Kate looming over her. "I wondered when it would come," Kate said. The restraints came loose, and Lucinda opened her eyes to see Kate offering her a hand up. She took it, using her free hand to wipe her face. Kate moved as if to hug her, but stopped and handed her a fistful of tissues instead.

Lucinda got her face almost dry. "Have I ruined the template? Or . . ."

"No. You doubled its effectiveness, if anything."

Lucinda hoped she was right. She didn't want to burn up the time for a second scan.

Kate went over to a workstation and found a mic. "Is that scan going to be sufficient, Dr. O'Doul?"

"Ample, Ms. Barber," came over the speakers. "Lucinda, can I have you up here?"

"Right away." She waited for Kate to close the link. "Kate, you should check the operating room. See that their equipment is up to our standards."

"Sensible enough," Kate said, just a bit anxiously.

They left the scanning room. The guards at the door followed them, one apiece. Lucinda felt hers like a weight between the shoulder blades. Once Kate and her shadow were safely down another corridor, she looked back. "I hope I'm not taking you from serious duties, corporal."

"Guarding you is my duty, Doctor," he answered, with a Southern accent too clipped to be a drawl. "I take that seriously."

Lucinda shook her head. "Do they really think someone's going to get under this mountain and assault me?"

"After this morning, I don't assume anything's safe."

She couldn't argue with him.

Building overlay templates was a job for neurosurgeons. Lucinda had only assisted Dr. Urowsky a few times with producing them; with Pavel, never. She was glad she had that modest experience, because it would have been too disturbing to have O'Doul building something out of her brain patterns while she sat to the side, doing nothing.

It was still creepy with her involved. They took the potentialities of strings of neurons, matching them as closely as possible with the captive's so they could replace one with the other. Those were the patterns, the tendrils of her thoughts, or at least the physical architecture that produced those thoughts. It was like having a mirror to look into her own soul.

The process usually took several hours. O'Doul had completed the work for the cingulate cortex while she was being scanned. Finishing up the frontal cortex took less than an hour with Lucinda's help. Finally, O'Doul pushed back his chair, gazed pen-

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sively at the screens, and nodded.

"You're ready, Doctor," Lucinda said in encouragement.

"Me?" said O'Doul. "Not we?"

"I'm not a neurosurgeon, Doctor, or a nurse. I've only attended one overlay."

"That's probably one more than anyone else they could provide me here," O'Doul said, "unless there's been another abduction we haven't heard about. Even if there has, I should like to have someone in there that I know, even a little."

There was only one response: the one Lucinda wanted. She had hoped to participate all the way, but that needed to be O'Doul's decision, and now it was. "Then let's go," she said.

By the time they dressed, sterilized, and entered the operating theater, the procedure had already begun. The subject was anesthetized, and a nurse was shaving off the last of the hair on his skull. "No transcranial stimulation?" Lucinda asked.

The nurse flicked away the last of the hair, and looked up. "No time to bring in a TMS machine," she said, the eyes above her mask dark and narrow. "We got the electrode-placing robots in just two hours ago. Mount Weather wasn't meant to be a research hospital. Sorry."

"No, I understand." So, this place did have a name.

"Of course not," O'Doul echoed. He looked over the available equipment, including the smaller MEG the OR had. "Yes, this will suffice. Is everyone ready?"

Ready or not, they had no time to waste, and they began. A sterile wrap went over the patient's head, with two holes over the entry sites. O'Doul made the first incision at the crown, peeling away the skin and fastening it back with tiny clamps. Then came the bone drill, neatly cutting out a plug of cranium the size of a dollar coin. O'Doul slit and parted the dura, and there was the brain, right where the frontal lobe blended into the parietal.

He and Lucinda threaded the electrode filaments down the longitudinal fissure between the hemispheres of the brain, getting them close to the cingulate cortex. From there, they fed instructions to the tiny robots attached to the filaments, to guide them down to the precise locations needed for the electrodes. "Looks good," O'Doul finally said. "Let's get him in."

They slid the operating table to get the patient's head inside the MEG. Lucinda went to the control panel for the electrodes, and sent some test pulses. O'Doul looked over the scans that resulted, and found two electrodes slightly misaligned. They pulled him out, and got to reprogramming the microrobots.

"Does it always take this long?" their nurse said as she applied suction to clear some pooling blood.

O'Doul scowled over his mask. "There is no hurrying brain surgery."

"Transcranial is much faster," Lucinda added. "Your bosses should get a TMS machine here, if they want us doing more of this."

"You think that's likely, Doctor?" O'Doul asked.

"I can't imagine whoever masterminded the attack dealt directly with this guy. There are always layers. It might—"

"You might want to stop speculating," the nurse snapped. Lucinda was taken aback, but neither she nor O'Doul said anything.

The second time was the charm, as the test pulses showed everything in place. "Start the overlay sequence," O'Doul said. Lucinda touched the button, and it began. Currents flowed through into the brain, shaping old neural pathways into new networks of activity.

"I can monitor the repotentiation," Lucinda told O'Doul, "if you want to take a break." The overlay would need

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more than an hour to impose its pattern.

"Not at all, not at all. Better I keep my mind occupied."

They kept their vigil, almost superfluous as the program did its work. Lucinda took intermittent looks at the patient. The MEG housing obscured part of his face, and the rest was blank, revealing nothing. She looked hard for some sign of what was happening inside his mind, before she made herself stop.

The program ran until the patient's MEG scans matched the template, and they could bring him out. Once the electrodes were out, the nurse replaced the plug of bone and sealed up the scalp, while the doctors opened the second hole over the prisoner's prefrontal lobe. The electrodes went in, the patient went back into the MEG, and the overlay began again—only this time it was Lucinda's pattern being imprinted.

She didn't feel the shiver of horror any longer. In its place was vague worry, that the procedure would fail, that she would bear double blame as participant and template. She tried to think of other things, but after enough thoughts of Washington, of Nancy, of Sam, she retreated to the worry of failure. That might go away before long.

From the first human trial of neural overlay, Lucinda had wondered whether this procedure effaced personhood, changed the soul. It had nagged her quietly with each person who underwent it, no matter what acts he had committed. She noticed she didn't feel that worry now.

"I think it's done. Do you concur, Dr. Peale?"

She shrugged off her musings, gave the display a look, and concurred with Dr. O'Doul. They pulled out the subject, withdrew the filaments, sealed up his skull, and put in a shunt. It was while O'Doul was applying wound glue to seal the incision that Lucinda noticed the anesthesiologist pulling out the IV. "That's a little early," she said.

"We need him awake and talking as soon as possible," he answered.

"That means topical anesthetics for his scalp," the nurse added. "No opiates or other narcotics."

"Yes, okay," Lucinda said. She hadn't forgotten their urgency. "Can someone call Kate Barber? She should be on hand when he wakes, for the interview."

Two disbelieving stares met her words. "We have people to handle that interview," the nurse said. "We won't need Barber, or you."

"What?" Lucinda said, in unison with O'Doul. "But someone has to monitor the MEG," she went on, "to see how the templates have taken hold, to—"

"We'll handle that." The eyes above the mask softened. "It's very late. You two have to be tired."

"I'm on West Coast time," Lucinda said feebly. The nurse didn't answer, going instead to the OR door. She called in two orderlies, and told someone else to make sure the recovery room was secure.

Lucinda turned to O'Doul, who was done closing. "How do we stop this?" she asked. "Can we?"

"Should we?" he replied.

"I don't like leaving my work for people I don't know to finish."

There was no more time for discussion. The orderlies were there, one securing his left arm, the other binding his legs, making the patient a prisoner once more. Lucinda took a last look at him. His eyes were slits, showing the stirrings of returning consciousness.

Then they shot open.

Lucinda only had time to touch O'Doul's sleeve and whisper "Edwin," before the man lunged. His bonds cut the lurch short, but he still reached the instrument tray with his free hand, and grabbed the biggest scalpel. His eyes fixed on Lucinda, frenzied. She could-

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n't look away. She couldn't move away.

He swung the scalpel—into his own wrist. Blood spattered Lucinda's face. The moment of near-frozen time crashed into bedlam—shouts—hands grabbing for his arm—a second slash of his wrist arrested mid-stroke—his arm yanking free.

Lucinda wrapped a hand around his wrist, trying to squeeze the scalpel free. He jerked his arm, knocking her off-balance. A second jerk, and the blade connected with her flailing free hand, biting through latex into her palm. She almost lost her grip, and he dragged the scalpel toward his bared neck.

Two pairs of hands grabbed his elbow and yanked. The scalpel flashed through the air, and clattered across the floor. He thrashed once more, reaching for the tray, but Lucinda and the orderlies pinned his free arm.

Then he screamed. What began as an animal howl became a quavering, tormented wail, leaping and plunging in pitch, going on seemingly forever until it began to sputter with sobs. Lucinda turned her head, and saw agony.

"Why did you stop me?" he cried. "I want to die! Oh Christ, I deserve to die!" His wail began again, now a spent echo.

Lucinda had never been there when a patient woke up. Had any of them been like this? Or was he unique, with so much on his conscience?

She grabbed his face, a hand on each cheek, and made him look straight at her. "Not anymore, you don't," she said. "Tell them everything. Start making amends, now."

He gave a wide-eyed nod. She pulled away, leaving a smear of her blood on his cheek. The nurse and orderlies started working on his gashed wrist.

"They recruited me nine months ago," he said. "Two of them. Sayyed was—"

"Get them out of here!" the nurse said. One of the orderlies hustled away the two doctors, as O'Doul was still tending to Lucinda's bleeding hand.

The double door shut behind them. O'Doul sighed. "I guess that was a success."

"I guess so." Lucinda's breath started turning ragged. "God, I hope so."

IV

Lucinda awoke groggily. Without looking at a clock, she knew she had slept long. She took a shower, and dressed in clothes starting to get stiff and smelly on her third day under Mount Weather. After a second's hesitation, she went to open the door.

It would not open.

"Can I help you, ma'am?" said someone outside, presumably the guard. "Can I get you breakfast? Or lunch?"

Lucinda was ready to start demanding answers—but if what she feared had happened, they wouldn't do her much good. "Lunch, please," she answered flatly.

"Right away."

Lucinda retreated to a chair. Was this how Kate and Edwin had disappeared? Had they lasted as long as they were useful, as long as the authorities required to prepare someone else to do their work? Maybe she should take pride in being last to go. The thought was barely in her mind before she rebuked herself for it.

She had worked through three overlays yesterday. Someone had replaced Kate for the second interrogation session, and her inquiries gained no information. Then they took her out of the second operation to monitor the third interrogation. O'Doul had never joined her during that job, and when she reached the operating theater, there was another surgeon in O'Doul's place. He was resting, they said, and in her fatigue Lucinda had accepted that explanation. She wondered how they'd explain her absence now, before remembering there was no one left to

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ask.

When the lunch trolley arrived, Lucinda tried to skirt past the steward bringing it. Her guard stepped smartly into the doorway. "Please stay inside, Doctor."

Lucinda knew better than to try him. "Could you at least see if I might speak to Kate Barber? She's my colleague. We were brought here together."

"I'll see what I can do, ma'am." The steward left the room, the guard closed the door, and a click announced it was locked again. Lucinda started in on her meal, watching the door.

An hour later, long after she had finished eating, they came for the used trolley. "What about Kate?" she asked the guard.

"Nothing yet."

"Then try Dr. O'Doul. We were working on the overlays together. It's important that I consult with someone."

"I'll see what I can do," he said, and shut her in again.

Lucinda knew what that meant now. It wasn't his malevolence: he was under orders. Still, he was her only link to the outside, and she had to work on him.

"Your superiors are treating me like a prisoner, Corporal Lemmer." She had taken pains to look at his nametag and rank insignia while lunch was being cleared away. "I was brought here in hopes of tracking down whoever destroyed Washington. I gave them that help. So did my colleagues. This is what it's earned us. If nothing else, I'd like to know why."

She let that question work on him awhile, then started anew. She told him about Sam's fate back at Berkeley. She told him about Kate's young daughter, whose father was in Missouri. She told him about her dog Ben stuck home without her, saying nothing about Josh looking after him. She would have said something about O'Doul's missing person at Georgetown, but didn't know whether that was family or friend, male or female.

Footsteps in the corridor interrupted one monologue. She waited, but they left again. So much for getting results. She started in again, but got cut short when she appealed to her guard by name. "I'm not Lemmer, ma'am," the new voice said.

Of course they wouldn't keep one guard permanently in place. She renewed her campaign, but slowly ran out of steam. What could she do, appeal to every soldier they had in this place as they cycled past her door?

Her appeals dissolved into pleas. "At least bring me some news from outside, what's happening in the world. Or some books. Anything to occupy my time in here. God knows how much of it I'll have."

The hours crept past until dinner. The usual steward arrived with the usual trolley. She briefly contemplated starting a hunger strike, which struck her as so self-martyring that she ate much more than her dulled appetite warranted.

An hour later, the steward returned, took the trolley, and left some items on her table. There were two thin paperback books with worn spines, plus a handheld computer puzzle.

In a flash of inspired desperation, Lucinda riffled through the pages of the books, looking for any concealed message folded between the pages or scribbled in the margins. She found nothing, of course, and she laughed bitterly at herself for even trying.

She read the covers of the books. No Solzhenitsyn, which would have showed somebody had a sense of humor here, however warped. Not even an old Tom Clancy book, with massive terror attacks against America, and having the saving grace of being long and time-consuming. Just a pair of pedestrian detective novels. Nothing worth her time. She set them aside.

Half an hour later, she picked one

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up, and read halfway through it before feeling tired enough to sleep.

Late the next morning, she had broken down enough to start playing the puzzle game. The moment she heard the snick of the unlocking door, she guiltily shut it off and put it on the end table, behind the books.

Two soldiers looked in through the open door. "Dr. Peale, would you come with us?"

She barely had the energy for a jaundiced look. "What is it? A new patient? I didn't know I was doing that work anymore."

Their expressions didn't shift. "Come with us, please."

She obeyed. There was no point in resisting just to resist. They led her outside—a relative term inside the Mount—to a waiting cart, and drove off. She turned to look at the pond and fountain as they passed, but the sight gave her no pleasure. It was an artifice, an attempt to make this place something it wasn't.

They slowed as they approached a white-fronted building with a heavy guard. Not another hospital, surely. A prison? That seemed redundant. Her guards bundled her out of the cart, toward a checkpoint at a side door. There they checked her badge, took a retina scan, and passed her through to another set of soldiers.

They led her inside, down bare hallways, up a flight of stairs, to another checkpoint. They scrutinized her again, and passed her again, this time to escorts mostly clad in suits. They took her down a hall with a brighter paint job, into an anteroom. That's where she got thoroughly checked. She submitted quietly to it. By now, she believed she knew the reason.

They finally satisfied whatever arcane requirements they had, and two of the suited escorts led her through one last door into the office beyond. One look confirmed Lucinda's belief. The room was oval.

Two agents stood at opposite sides of the room. A third man was hunched over the desk near the far wall, writing. His thin, graying hair was unkempt, his tie was crooked, and his suit jacket was rumpled, almost as if it was too big for his shoulders. President Lewis Burleigh made Lucinda forget her self-consciousness about her own appearance, but that was scant comfort.

"Dr. Peale, please sit down."

The President said it without standing, with barely a glance upward. She walked slowly to one of the chairs in front of the desk. The door clicked shut behind her, with one of her guards remaining inside, standing before it at parade rest. As Lucinda sat down, Burleigh finished his writing, and uploaded it from his pad to the console on his desk. Finally he looked up, quietly appraising her. She returned the look.

"Dr. Peale," he said, his high voice a little tired, a little nasal, "first let me offer my personal sympathies for the three colleagues you lost in Washington on Friday."

Lucinda tightened all over. She had held no hope, but this note of finality was still a blow. "Is that confirmed, Mr. President, or are you . . . just assuming the obvious?"

"I'm afraid it's confirmed. We excavated the shelters beneath the Capitol complex, what was left of them." His eyes looked past her. "No shelters seemed to be enough that day."

Lucinda read between the lines. "You have my condolences, sir, for all the colleagues you lost as well."

Burleigh nodded absently. "They died in service to their country, as I consider your three associates to have done." He shook off the sorrow. "Speaking of service, you've rendered us important service over the last few days. You have your nation's thanks for your aid in examining the men we cap-

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tured and brought here."

"You're welcome, Mr. President. About those men, I wonder whether I could have access—"

"Excuse me. I have rather more to say." The suddenness of the rebuff stopped Lucinda cold. "I would say thanks for helping bring those men to justice, but in their altered condition, I find that's taken on a different meaning. It's a meaning that I think needs wider currency, and that is where I am asking you and your colleagues here to continue helping us."

Lucinda showed no reaction. He could have his say, but it would have to be pretty spectacular to move her. His first words were a fair start.

"The world is poised to annihilate itself, either all at once or piece by piece. I will not permit the former, but right now I am powerless to prevent the latter. We saw on Black Friday that, when people are determined to kill and destroy, they will find a way to do it. And it's only getting easier for them to acquire the means, whether it's to destroy a neighborhood, or a city, or a country.

"It's a flaw, inherent in human nature—so human nature must change.

"Raising our defenses won't work. Aside from whatever flaws would remain, like homegrown attackers, it would be an exponential drag on the economy, grinding it to a halt. I have some very perceptive advisors confirming my intuition on this matter."

"Did you happen to have Agent Morris Hope advising you, sir?"

The President received the question worse than Lucinda suspected he would, with the lines around his eyes deepening sharply. "God, not him. I know how much initiative he showed bringing you here, but the man is a menace. He didn't spend that flight filling your head with claptrap about China, did he?"

Lucinda remembered the glimpse she had gotten of the last prisoner's face before he went into the scanner, his particular Asian features. "He mentioned them once," she said, "as one of the dozen or so entities that could have bombed Washington, along with Second Al-Qaeda, Pakistan . . . Iran." O'Doul had recognized their third detainee's curses at Kate's replacement as being in Farsi. He had had Iranian graduate students, years ago.

Burleigh's face creased again. "Hope was chomping at the bit, wasn't he? That doesn't surprise me. He'd have me retaliate against nuclear powers, touch off the holocaust we avoided once with the Russians, end the world, and call it justice."

Lucinda wanted to say that wasn't how Hope thought. She also wanted to ask whether China and Iran really were responsible. Lone nationals weren't cast-iron proof, and Burleigh surely knew more. She held her tongue.

"It is that kind of person," Burleigh continued, waving an upraised finger, "that kind of personality that would commit such appalling acts, that must be remade. Whatever those poisonous elements are, either innate or perversely cultivated, must be wiped clean from them, from all humankind. Do you see what I am getting at, Doctor?"

She did. Horrified as she was, she could see how she, too, might conclude it was necessary. "I think so, Mr. President," she said slowly, "but that's a dead end. Enemy nations, terrorist groups, would never submit to it."

"They will. There will be irresistible international pressure to accept curative overlays—because we will lead by example. We will purge America first, and about time."

Lucinda's head spun. "Of whom? Of terrorist personalities? Of sympathizers with terrorists?"

"Oh, that's just the start. There are other people just as dangerous to the world. The revanchists, for one, the people who would have me destroy

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whole countries for this act, and who will do it themselves if they ever gain the power to do it. And beneath them, there's a whole base of intolerance and primitivism that lets those violent attitudes flourish. Their debased mindsets are a luxury we can't afford anymore. No. No, we never could afford them. They brought us to this pass."

He gave Lucinda a strained smile. "I actually got to see Dr. Petrusky's testimony about this, after the fact. It was persuasive. He can claim partial credit for the decision I've reached. I hope he would be proud of that."

Lucinda could barely whisper, through a closed throat, "I imagine he would."

"It's sad those three aren't still with us. We need every trained overlay neurologist and technician we can pull together: to perform the treatments, to train others, to streamline the process so we can handle the numbers this will encompass." The President ran a hand over his disheveled hair. "It's a lot of work. But the good people of America will be behind us. They'll understand what has to be done to make a clean start on a better world."

Lucinda waited until she was sure he was done. "I think you'll be surprised, Mr. President. Starting now. I cannot participate in this."

Burleigh passed right through surprise into severity. "May I remind you, Dr. Peale, you already have."

"With a man caught red-handed, then with associates he named under circumstances that leave no doubt of their complicity—unless you're telling me that's not so." Burleigh mumbled some denial. "What you're talking about is forcible overlays on people who have committed no crimes, based on what? What they think? And this isn't just curbing their liberties, or confining them. We'd be altering them fundamentally, irrevocably."

She sighed. "I'm aware how fine the line is between ethical and unethical uses of overlay. I've been treading that line for seven years. So I've got some standing to say that this goes way over that line, and I will not cross it." She pushed herself up by the armrests. "I think I'll return to my room now."

"I think you will stay here, Doctor." The President didn't move. Neither did the agent standing between Lucinda and the door. She tried to reach around him for the doorknob, and found her hand firmly deflected by his. She wheeled on the President, who remained seated in silent thought. Lucinda didn't return to the chair, but waited with arms crossed, and that agent's breath tickling her neck.

Burleigh took his time before speaking. "Many people would conclude, Doctor, that you already have crossed the ethical line. That procedure you performed on Mr. Lodish directly contr—"

"On whom, sir?"

Burleigh lifted his eyebrows. "The missile launcher. The first man you had overlaid."

"I see. I never learned his name before now."

"Oh. That doesn't matter. Your operation directly contravened federal laws regarding humane treatment of persons held in custody. You committed a gravely serious act, Ms. Peale."

Lucinda boggled at this ploy—and noted in passing that she was no longer "Doctor" to him. "So, you're telling me I've committed an awful crime, and you want me to commit lots more as penance."

"It isn't a crime now. I signed an executive order on the matter, the morning after the attack. Your other overlays are covered, but not, I'm afraid, the first one."

Lucinda glared. "Is this the threat? That I'll be locked up for turning a remorseless terrorist conspirator, complicit in destroying the nation's capital, into a man with a conscience?"

President Burleigh lifted himself up.

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"You mean cutting open a man's skull, jabbing electrodes into his exposed brain, and doing a mind-wipe on him that sets him to slashing his wrist, and begging for the release of death? There's a word for that: torture." He looked down at her hand. "As for his conscience, you didn't give him enough of one to keep him from injuring you."

Her palm throbbed. She yearned to reply, but what was the point? This wasn't about reason. It was about power—and she had none here. She wasn't getting out of this place, certainly not if she didn't play ball.

She had misjudged this man. He was no drone, and that was no blessing.

"That's what awaits you," the President said, "if you don't own what you've done. We can prevent that, *if* you will work with us. You can consider it mutual assistance, if you're so inclined. You can also consider it a plea bargain, if you're inclined that way."

"My term is 'extortion,' Mr. President."

"Your attitude is your problem, Ms. Peale. The choice is there before you. I can give you time to think it over, but not much." He motioned to the Secret Service. "Take her to the holding area."

Two of the agents took her in hand, leading her toward the door. As one opened it, she turned over her shoulder. "I don't need that time. I've decided." She saw Burleigh scowl, and the agents' grip on her stiffened. She nearly reconsidered before going on. "I'm ready to work here."

She had the satisfaction of seeing the President's jaw drop, meager consolation that it was. He was going to take this course, with or without her. Her choice was between the invisible martyrdom of refusal, or working within this project, mitigating its abuses as much as she could. That was a worthy goal—and she didn't have the nerve to try the alternative.

Burleigh quickly gestured to the agents to turn her loose. Once they did, she finished her sentence. "But I'll need some guarantee that I won't have the overlay of Mr. Lodish held over my head."

The President grew guarded again, and Lucinda much preferred him that way. "What guarantee?"

Lucinda rolled her shoulders to get circulation back into hard-gripped arms, and strode halfway across the oval room. "If that procedure was a crime, as you allege, then I think a Presidential pardon is in order. In writing, with your signature, and in my hand before I leave this office."

"You're asking rather a lot, Doctor."

"Under the circumstances, I'm asking rather little, compared to what I'll be giving you." *Like my soul.*

Burleigh's eyes drifted downward as he thought. Finally, he turned to his computer. "Very well." Lucinda felt a spurt of triumph, and got ready to name her next conditions. "But," he continued, "let me make all the terms clear."

"I have rather more to say."

"Not now, you don't. You are not going to have freedom of communication or movement while under our auspices. You'll be working in a secure federal facility, probably here at the Mount, at least at the start. You aren't going to tell people where you are or what you're doing without our explicit permission. You won't be communicating *anything* to anyone outside without our permission, and oversight. Do you understand?"

"You're talking about censoring my letters, my e-mail, everything. That comes as no surprise."

"It shouldn't," Burleigh said, very matter of fact. "A Second World War project would have acted similarly."

Put that way, it almost sounded reasonable. Still, it meant severing herself from her regular life. Home, family, friends . . . Josh, whatever he was to her. Even poor Ben: he'd have no place

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here. Josh might have to take him in. She might not see him for a long time. Either of them.

What would Josh have told her to do here? He had said overlay was too powerful to leave to people eager to use it. But he had said that when she about to challenge the system, not work inside it. She wanted him here to guide her, and knew it was impossible.

"I . . . accept those restrictions, sir."

"And will you sign an agreement along those lines?" Burleigh saw her balk. "If you're expecting that pardon—"

"I know what deal I'm negotiating, sir." Lucinda needed to wrest away his upper hand. "Will you be keeping Dr. O'Doul and Kate Barber here as well?"

"O'Doul, yes. Barber, we don't need. Her skills aren't that vital."

"Can I see her before she goes?"

"She's . . . already out of the Mount. Now, that signature."

Lucinda knew the President was dissembling. Kate had refused him, and probably wasn't headed home. She wanted to cheer, or rail, or throw his words back in his face. She did none of those, with an act of inhibition that was already becoming second nature. She knew her limits here.

"Our signatures, you mean," she said. "I think you should draw up those papers."

He bent over the keyboard, and hammered away fast. Not giving her time to back out, she guessed. Let him think she might, for whatever psychological edge it might grant her.

And Lucinda did wish, intensely, desperately, that she could back out. Pavel might have made common cause with the President willingly. So might Nancy, who had been so adamant on not aiding acts of reprisal. But it was her here, not them: one small irony, adrift in the oceanic nightmare of the last few days.

She had done this before. She worked under Dr. Petrusky's de facto control of the Berkeley program. If she could stand that, for a while, she could stand this, for a while. But when she couldn't stand Berkeley any longer, she had the choice of leaving. She wouldn't have that here.

One year, she told herself. Burleigh could not last forever. The country would not stand what he would do. They'd stop this, maybe by sheer mass of outcry, surely no later than the November election. If he held one.

Lucinda screwed her eyes shut. She would drive herself insane if she dwelt on such thoughts. *One year,* she repeated. *I can endure one year.*

"Is there a problem, Doctor?"

Her eyes blinked open, a shimmer of tears fogging her vision. "It's catching up to me," she said, not looking at the President. "All the people I've lost; all the . . . things."

A printer began humming. "We have to look ahead," Burleigh said. "What's past will not return, ever."

Lucinda Peale stared at a bare stretch of the curved wall. *That's what I'm afraid of.* ■

(EDITOR'S NOTE: Earlier stories of the overlay project include "Acts of Conscience" [March 2005] and "A New Man" [October 2003].)

Everything is open to questioning. This does not mean all answers are equally valid.

—Kelvin Throop

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Science Fact

The Ice Age That Wasn't

Richard A. Lovett

How our ancestors may have held the ice at bay.

Anyone who pays attention to the news knows that the Earth is warming. As I write this, the latest report is that the rate of ice flow from Greenland's glaciers has doubled in the past decade. But by the time you read it, the only certainty is that this will be old news.

The main question is the extent to which humans have caused this warming. The Earth, the conventional wisdom goes, is rebounding from an ice age, but in the past 150 or 200 years, we have accelerated the pace as a byproduct of our use of fossil fuels. Prior to that, we were puny creatures incapable of affecting the global environment, and it is only modern technology that changed this.

But is that true? Not the modern technology part—few *Analog* readers would disagree that we have the ability to geoengineer the Earth on a large scale, and that the future will give us ever greater power. "Our leverage [over climate] keeps growing as our science gets better," David Keith, of the University of Calgary, put it at the Fall 2005 meeting of the American Geophysical Union.

But until recently, climate had a much more obvious effect on us than we had on it. Harvey Weiss, an archaeologist from Yale University, goes so far as to argue that civilization was created in reaction to a climate fluctuation that occurred about 8,200 years ago. He bases this argument on the fact that humans have been on the planet a long time, but it was only then, in ancient Mesopotamia (today's Iraq), that they began banding together into anything more complex than scattered tribes and villages.

"The biggest question in Mesopotamian archaeology is why there even is a Mesopotamian archeology," he said at a 2003 geophysics meeting. That's because, at first glance, Mesopotamia isn't the most inviting place. It's a desolate area "that looks like what you see on CNN every night. Bleak, dismal, and parched, only watered where the Eu-

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phrates has its course." It can be farmed, but only at the cost of a lot of work, building and maintaining irrigation canals. Cooperating to do this was obviously a boost to civilization—but why bother?

Weiss argues that the answer lay in the aforementioned climate change: an abrupt cold shift and drought that lasted 200-300 years.[1] This forced people to migrate to the water, where they had to work together to learn irrigation. By the time the climate moderated, civilization was established.

Sara Parcak, of the University of Cambridge, believes that another abrupt shift, about 4,200 years ago, produced droughts that contributed to the collapse of Egypt's once-powerful Old Kingdom. Similarly, many archaeologists believe that drying climate in the American Southwest may have forced the Anasazi to abandon the cliff dwellings that delight today's tourists. More recently, a series of wet decades in the early twentieth century lured farmers to places as unlikely as California's Mojave Desert and the sagebrush steppes of eastern Oregon, where ghost towns still dot the land. And in early 2006, South African scientists calculated that global warming would eliminate a sizeable percentage of the continent's arid-region creeks by the end of this century—a potential catastrophe for some of the world's poorest countries.

Swamp Gas

But dependent as humans were (and are) on weather, were our distant ancestors really too weak to make an impact?

Not so, says William F. Ruddiman, a retired professor from the University of Virginia. That's because 12,000 years ago, they discovered agriculture. And within a few thousand years, that gave them so much (unintended) power over climate that the Earth wouldn't be "naturally" warming without them.

Ruddiman begins by noting that ice ages are caused by variations in the Earth's orbit that alter the amount of sunlight reaching Canada, Siberia, and Alaska during the brief arctic summer. During high sunlight cycles, there's enough warmth to melt the previous winter's snows. During cold ones, there isn't, and snow gradually accumulates into glaciers.

These orbital variations occur in three well-understood cycles.

1. A 41,000-year variation in the tilt of the Earth's axis. Discovered in the 1840s by French astronomer Urbain Leverrier, this is produced by the gravity of the outer planets and causes the tilt to vary from 22.2° to 24.5°. That changes the angle of the midsummer sun by 2.3°—small, but enough to significantly affect snow melting in the far north. Right now, we're in the middle of the range, at 23 $^{1}/_{2}$°, but we're heading toward the cold end.

2. A 26,000-year precession of the Earth's orbit around the sun.[2] Basically, this is like a top wobbling on its axis. The angle of the Earth's tilt doesn't change (except for the small variation noted above), but the *direction* slowly shifts. If the Earth's orbit were circular, this wouldn't matter. But it's elliptical, which means that sometimes the arctic summer comes when the Earth is closest to the sun, sometimes when it's farthest. Again, the effect is small but significant. In the first case we get warm summers and lots of melting.[3] In the other, we get cooler summers and less melting. And guess what: For the last several thousand years, we've been heading for

[1] Geophysicists can identify such things by numerous means, one of which is cataloguing pollen residues in sediments. Changes in pollen types reveal changes in climate.

[2] This was also discovered in the nineteenth century by French mathematician Jean le Rond d'Alembert.

[3] We also get colder winters, but that's not as important.

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the cold-summer end of this cycle, too.

3. A 100,000-year variation in the eccentricity of the Earth's orbit.[4] In some ways, this is most important because it exaggerates the effect of the precession cycles, making them more pronounced when the Earth's orbit is least circular. This one is also shifting toward its colder realm.

During the heart of the most recent ice age, 20,000 years ago, all three cycles combined to plunge the planet into the icehouse. By 11,000 years ago, when the glaciers were in full retreat, solar radiation reached a glacier-melting peak. Afterward, glaciers continued to melt (just as summer days continue to get hotter after June 21, the longest day of the year), but solar energy has been steadily decreasing: a trend that normally would lead into the next cold cycle.

All of this is reinforced by changes in the Earth's atmosphere, particularly regarding two important "greenhouse" gases, methane and carbon dioxide.

Greenhouse gases are ones that trap atmospheric heat. Carbon dioxide (CO_2) is the most plentiful, but molecule for molecule, methane (CH_4) is a good deal more powerful.

We can trace the levels of these gases back for thousands of years by measuring their concentrations in air bubbles trapped in arctic and Antarctic ice. At the time Ruddiman proposed his theory, scientists had used cores from Russia's Vostok station in Antarctica to do this for the past 400,000 years.

These cores reveal that during eras when the Northern Hemisphere receives weaker summer sunlight (i.e., ice ages), methane is lower. In eras when solar energy is higher in the arctic, methane increases.

This makes sense because methane is produced when vegetation decays beneath swamps and marshes. Many of these marshes are in the arctic, where, if the sun is weak, they're locked up in permafrost. If it is strong, permafrost melts, and swamps and marshes expand.

But that's only one factor. Another, probably more important, lies in Africa, China, and Eurasia.

It's long been known that these areas were a lot wetter 11,000 years ago than today. It's a fact attested to by dry lake valleys in the Sahara and huge reserves of groundwater in regions that see virtually no rain today.

Ruddiman argues that it is not by coincidence that these lakes existed when the northern summers were at their strongest. Even at moderate latitudes north of the equator (such as the Sahara and large areas in southern Eurasia), he says that summer sunlight was eight percent more intense than today. That produced stronger thunderstorms, a wetter climate, and lots of marshes, as well as lakes.

All of this appears to have been the case throughout the last several million years: Methane levels fluctuate with the 100,000-, 41,000-, and 22,000-year sunlight cycles, peaking when the northern summers are strongest and declining when they weaken.

This pattern means that the atmosphere's methane level should have reached a peak 11,000 years ago and been dropping ever since. And that's exactly what happened until 5,000 years ago. Then something went awry, and it began to rise.

"You have to throw 395,000 years of history out the window to come up with a natural explanation for this," Ruddiman said when he unveiled his theory in a lecture at the 2003 fall meeting of the American Geophysical Union.[5] "Something has overridden the natural system."

His not-so-natural alternative? Five thousand years ago was just about when

[4] This is yet another discovery of Leverrier's. Those nineteenth-century French astronomers were busy folk!

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people started creating artificial marshes to grow rice in Southeast Asia. Weeds, stems, and rice roots decomposing in these paddies would have released considerable amounts of methane. Since then, rice farming has continued to expand. As far back as 2,000 years ago, rice farmers had already used up the flat land of the valleys and were beginning to build the hillside terraces we see today, increasing their methane releases with each new terrace.[6]

The result is that preindustrial methane levels were about the same as those 11,000 years ago, when African and Eurasian thundershowers were at their highest and marshlands were spreading behind retreating glaciers. That's about 25 percent higher than they were at the time the trend reversed and 60 percent higher than would be expected if the "normal" cycle had persisted.

The current level is about 1750 parts per billion. That may not sound like much (carbon dioxide levels are more than 200 times higher), but methane is a powerful enough greenhouse gas (twenty times as powerful as carbon dioxide, according to the website of Oak Ridge National Laboratory) that this is enough to play a major role.

Wrong-Way CO_2

Atmospheric concentrations of carbon dioxide have shown a similar deviation. Antarctic ice cores reveal that CO_2 levels fluctuate on natural cycles of 22,000, 41,000, and 100,000 years. The reasons aren't well understood, but the pattern is quite evident, especially for the 100,000-year cycle, which has thrice produced 80 ppm (40 percent) oscillations in the past 350,000 years.

One theory is that carbon dioxide is affected by the extent of pack ice in the oceans. That's because the ice reduces the amount of water coming into contact with the air, thereby reducing the rate at which carbon dioxide can be transferred from the atmosphere to the oceans. Less ice equals more CO_2 removal, which means a gradual decline in atmospheric CO_2 between ice ages. Another theory is that big ice sheets affect ocean circulation patterns in ways that produce a similar effect.

A third theory says that because ice ages are dusty, more dust blows into the ocean when glaciers are at maximum. This dust is rich in nutrients, particularly iron, which fertilizes the growth of plankton. That removes carbon dioxide from the water, then sequesters it in the depths when the plankton die and sink to the bottom. Deliberately dusting the ocean with iron (a key nutrient) has even been proposed as a method of fighting global warming, but in a pilot-scale test, called the Southern Ocean

[5] I first encountered Ruddiman at that lecture. A technical version of his hypothesis was published shortly after in *Climatic Change*, 61(3), December 2003, pp. 261-93. Now he's back with his thesis neatly packaged in a book, *Plows, Plagues & Petroleum*, which is must reading for anyone seriously interested in climate theory. This article is based largely on the lecture, with additional details drawn from the book, which also lays out a great deal of background material and the thought processes that led to his hypothesis — all at a level that is easily accessible to lay readers. Highly recommended.

[6] Other activities also produce methane, including the rearing of domestic animals. In the last quarter of the twentieth century, human-caused releases rose sharply, but a new study in the November 23, 2006 issue of *Geophysical Research Letters* has found that there has been no additional rise since late 1998. Most likely this good news is the result of improved maintenance at natural gas pipelines, said the study authors, who included Sherwood Rowland of the University of California, Irvine, co-winner of the 1995 Nobel for discovering the link between ozone depletion and chlorofluorocarbons in such products as aerosol sprays.

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Fertilization Experiment (SOFeX), it looked to be impractical.[7]

All three mechanisms would produce CO_2 levels that fluctuate cyclically with the glaciers: exactly what the ice cores show. Thus, carbon dioxide, like methane, should have reached a peak 11,000 years ago and dropped ever since. But it, too, dropped for only the first part of that cycle, then started to rebound—so much so that at the start of the industrial age, the level was already 15 percent too high.

Other scientists have posited a variety of natural theories for this reversal. One is that changes in ocean chemistry are causing the seas to disgorge large quantities of previously absorbed carbon dioxide. Another is that it is due to a natural decline in forests, which remove CO_2 from the air to form branches, leaves, bark, and roots. But Ruddiman again suggests that humans might be the cause.

Studies of pollen particles trapped in lakebed sediments allow scientists to trace the spread of wheat, peas, lentils, flax, and barley across regions that were naturally forest. They reveal that as far back as 10,000 years ago, people were beginning to cut down forests to make room for farming. These bogs, Ruddiman says, also reveal increasing levels of sun-loving weeds from cleared land, plus soot from slash-and-burn agriculture.

These facts may have been overlooked by climate modelers, but Ruddiman discovered that they are well known to historical geographers. In 1989, Ian G. Simmons of the University of Durham, England, wrote that by 2,000 years ago, large segments of Southeast Asia, China, Southwestern Asia, and the Mediterranean region were "greatly" deforested. And in a 2003 book, *Deforesting the Earth*, Oxford geography professor Michael Williams reported that humans were already cutting down European forests 6,000 years ago.

Even North America was affected. As far back as 7,000 years ago, Williams wrote, Native Americans were clearing forests in the Mississippi River Valley to plant squash, sunflowers, maize, and beans.

By the time of the Roman and Chinese empires, the effect had become quite pronounced. "Most of Eurasia was deforested by the time of Christ," Ruddiman said in his 2003 lecture.

In an effort to quantify the amount of preindustrial deforestation, Ruddiman turned to the Domesday Book, a census of Britain conducted by William the Conqueror in 1086 AD. In addition to counting people, William's census-takers tallied the extent of forests, fields, and pastures. According to figures in the Domesday Book, the 1.5 million people then living in England had already cut down 85 percent of their nation's trees.

Extrapolating these per-capita land-clearing figures to the 57 million people living in China a thousand years earlier, plus the 140 million more in India, Southeast Asia, and the Roman Empire, Ruddiman calculates that 2,000 years ago, tree-cutting had released 700 to 900 billion tons of carbon dioxide to the air—enough to offset the natural decline and start driving levels of the gas back up again, thousands of years before anyone was using significant quantities of oil.[8]

Ruddiman's bottom line: All those years ago "humans were doing things at

[7] There were several articles on this topic in the April 16, 2004 issue of *Science*.

[8] Our ancestors did use peat. And by 3,000 years ago, the Chinese had discovered coal. In his book, Ruddiman estimates that emissions from these could have put another 120 billion tons of carbon dioxide into the air. Note, by the way, that I have stated these figures as tons of *carbon dioxide*. In academic books and papers, the same figures are often given as tons of *carbon*. A ton of carbon dioxide contains only a 545 lbs of carbon.

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a scale that can explain why the natural trends went haywire."

He backs up his tree-cutting theory by pointing to several dips in the atmospheric level of carbon dioxide that occurred over the past 2,000 years. None was large—only a few parts per million—but they appear to be too much to be explained by natural factors such fluctuations in the rate of volcanic emissions.

One dip occurred during the late years of the Roman Empire. Another was in the 1400s, and a third was between 1500 AD and 1750 AD. All three, Ruddiman says, link to periods when plagues killed off sizeable fractions of the world's population.

The first occurred at a time when bubonic plague killed 20 million people in China and the Roman Empire: roughly one-tenth of the world's then-population. The second correlates to the Black Death, which killed one-third of the people of Europe in its first year alone. The third was during an era when 90 percent of the 50 million to 120 million people living in Central and South America died of smallpox, measles, and other European diseases: the single largest mass mortality in history.

When that many people die, farms are abandoned, and trees grow back quickly enough to take significant amounts of carbon dioxide back out of the air. Historical accounts of the Black Death, Ruddiman says, are full of stories about millions of abandoned farms. "These accounts don't give numbers of farms or acreage," he said, "but it's immense."

Another intriguing aspect of these plagues is that the last one more or less coincides with an era called the Little Ice Age. During the heart of that period, from about 1550 to 1850, northern climates saw a temperature drop of about one or two degrees. That may not sound like a lot, but it allowed glaciers to surge in Alaska and froze the canals of Holland memorably enough that the Dutch are still speedskating fanatics. Could the Little Ice Age have represented the Earth's attempt to return to its normal cooling trend, thanks to the reduction in human-caused CO_2? If so, a lot of low technology alternate-history books and fantasy novels need to be rewritten to include more ice and snow.

Bye-bye Ice Age

The timing of these wiggles adds yet another line of support to Ruddiman's claim that land clearing was the driving force behind the preindustrial increase in carbon dioxide. Over the course of 8,000 years, he says, enough of the Earth was deforested to raise CO_2 levels by 40 ppm over what they "should" be.[9]

Combined with the increase in methane, Ruddiman argues, that's enough to warm the Earth by about 1.4°F—roughly the same amount that industrial-era emissions are believed to have warmed it to date (but not as much as today's emissions are expected to warm it in the future).

At the start of his 2003 lecture, Ruddiman announced that he would present four "outrageous propositions." So far, we've discussed three:

1. Several thousand years ago, atmospheric levels of methane and carbon dioxide started an upswing that is contrary to their normal cycles.

2. These changes were caused by puny, preindustrial humans.

3. Humans have had twice as much effect on climate as was previously believed. (The unrecognized half was before the Industrial Revolution. The other half is modern.)

His fourth claim is the true kicker. "The most in-your-face statement I can make is that humans stopped a glaciation," he said. "And I think there's a strong case that can be made for that."

[9] That 40 ppm is comprised of a 20 ppm actual rise, plus 20 ppm of normal drop that didn't occur.

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A 1.4° warming may not sound like much, but (as with all climate-change scenarios) the effects are magnified at high latitudes. They're strong enough, he argued, that climate models show that if people hadn't irrigated rice and cut down so many trees, huge areas of North America would see mean annual temperature decreases of 5°F to 7°F. The result would be year-round snow cover in Canada's Baffin Island, and eleven-month winters in the Labrador highlands: the two areas from which prior glaciations appear to have originated.

If anything, the models Ruddiman used to calculate these effects may have understated the impact. That's because they weren't sophisticated enough to take account of climate-driven changes in arctic vegetation.

By comparing old photos with present landscapes, researchers in Alaska have noted that today's warming trend has produced significant vegetation shifts, most notably a dramatic increase in the prevalence of woody shrubs in lands that previously were tundra. This changes the amount of solar heating. In an article published in the September 7, 2005 issue of the *Journal of Geophysical Research—Biogeosciences*, Matthew Sturm of the U.S. Army Cold Regions Research and Engineering Laboratory and colleagues reported that the dark branches of these shrubs, protruding above the snow, absorb a lot more sunlight than do low-lying tundra grasses. In his experimental plots, Sturm discovered that spring melting began several weeks earlier in shrubby regions than in unbroken tundra.[10]

During a cooling period, the same factors would work in reverse. Rather than expanding their range, shrubs would retreat. The same would happen to evergreen forests, whose dark needles also absorb a lot of sunlight. These vegetation shifts would amplify the effects found by Ruddiman's climate model, quite possibly by enough to produce incipient glaciers in Labrador, as well as Baffin Island. Whether these glaciers would now be spreading south remains an open question—and a fruitful topic for an alternate history story.

Latest Cores

It will be years before scientists can be sure whether Ruddiman's theory is correct. Shortly after he unveiled it, I talked to Ralph Keeling, a professor of geochemistry at Scripps Institution of Oceanography in La Jolla.

"At some level," Keeling said, "it seems inevitable that early agriculture would have had an impact on the atmosphere. The question is simply how big." But he added that confirmation of Ruddiman's theory would require the drilling of ice cores going back more than 400,000 years.

The problem was that the Antarctic ice cores on which Ruddiman was relying only went back far enough to capture the three most recent repetitions of the 100,000-year cycle. And (in one of those Murphy's Law, "of course" realities) the one just before that turns out to be the one in which the orbital parameters were most akin to today's. If that earlier era showed the same methane and CO_2 anomalies we see in the current cycle, then the cause is natural and Ruddiman's theory goes down the drain.

Luckily, it turned out that there were a few feet at the bottom of the old cores that hadn't previously been studied due to difficulties in figuring out their age. That problem was resolved while Ruddiman was writing his book, allowing the chronology of methane and carbon dioxide levels to be pushed back just barely far enough to get him the information he needed. The result: a slight

[10] The effect is complicated by the fact that patchy snow may linger in shaded areas beneath the densest vegetation. Still, increasing shrubbiness substantially increases overall solar heating.

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change in the numbers, but confirmation of his overall hypothesis.

This brings us full circle to Weiss's theory of the early Mesopotamian civilizations. The 6200 BC cold snap—called the 8.2 Kya event by geophysicists—was an anomaly that had nothing directly to do with global climate change. But it did much to boost farming-fed civilizations by creating that ancient world's most powerful kingdoms. And that, in turn, instituted a long-term shift in climate.

Except during the cold snap, the Earth was warmer then than now, but steadily cooling. Since then, we've had one of the most stable climate periods in the last several million years. Anthropologists have long pointed to this as a fortuitous circumstance that helped prevent civilization from being erased by the next major climate change. But if Ruddiman is correct, this stability wasn't the result of some nicely timed Earth process, but rather the result of two offsetting factors: the Earth's slow, natural cooling, and the human-caused buildup in greenhouse gases. Thus, while the Earth was trying to enter a new ice age, it did not, and except for a few minor blips such as the Little Ice Age and the drought that may have toppled Egypt's Old Kingdom, nothing truly untoward happened for 8,000 years.

For science-fictional world builders, this raises all kinds of interesting questions. What if the two rates of change hadn't been so nicely balanced? Could the Romans have coped with an ice age? What would have happened if the world had been in a warming trend when farming was discovered, rather than a cooling one? Then, rather than offsetting, the two factors might have reinforced each other—and melting Antarctic and Greenlandic glaciers might have forced many low-lying civilizations to continually seek higher ground.

Now, the human factor is overwhelmingly powerful. As of 2006, the carbon dioxide level has overshot anything the Earth has seen since the dinosaurs and is heading off into what Ruddiman calls "terra incognita."

What exactly this entails is open for debate, but in the final chapters of his book, Ruddiman poses an interesting argument. The next few centuries might be a bit warm, he suggests, but eventually we'll run out of coal and oil. Soon enough (geologically speaking) the atmosphere will start purging itself of the extra greenhouse gases . . . and we'll still be in the present orbital cycle . . .

Get the book. It's one of the most intriguing climate hypotheses to come along in years. ■

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Don't Kill the Messenger

Kim Zimring

Sometimes packaging is everything. . . .

The sign said, "Found: Small Gray Alien with Velvet Eyes. If Lost, please Call . . ." and then it gave a local number.

Dr. Albert Finchi considered this as he looked up at the flyer roughly stapled to the telephone pole. He had spent his life at SETI waiting for some sign of sentient life, had listened to a hundred thousand beeps and pings of possibility, and had lately decided that he was fated to retire unsuccessful.

He tilted his head and considered the photo at the bottom of the flyer. It showed something small and odd, that was true, but the picture wasn't good. It was a prank, most likely, or possibly an ugly cat.

But what was a single phone call when his whole career had been built on a slim-to-nothing chance? He took the flyer down, flipped his cell phone open, and called the number.

It rang; the voice on the other end was male, older sounding, and somewhat thin and reedy. Yes, there was an alien, the voice said. He had found it in the park, crying. He gave it milk and cat food, but it wouldn't eat. No, he didn't have it anymore. A Mrs. Everett had come by and adopted it.

Dr. Finchi found himself lying. Generally speaking, it was out of the ordinary for him and he certainly felt bad, but still, if there was any chance at all . . . He found himself saying things like "my alien" and "absolutely irreplaceable" until the voice coughed up an address.

He arrived at Mrs. Everett's a few minutes ahead of the TV cameras and several hours ahead of the government.

It weighed about two pounds. It was gray and slightly fuzzy; it was burbly and cute with large and softly textured eyes, and it was quite unmistakably an alien.

Finchi couldn't resist picking it up, even as sensible precautions about quarantines flashed through his head. Nothing had happened to Mrs. Everett, though, and she had had it for over a day, and the man who had found it was obviously alive and talking too.

The media loved it. It sat in his arms and cooed up at him, and in the end he

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was glad he'd ignored those fears, partly because the alien turned out not to have so much as a flea upon it, and partly because by the time the government took over, he was too well-established as the Resident Expert on Aliens to get completely kicked to the curb.

Six months later he was still excited, even though the linguists were confounded. The best and the brightest, from all around the world, and not one of them could get the alien to say so much as "hi" in its own or any other language. A few months after that and the consensus seemed to be that it didn't have the capacity for language, which puzzled Finchi.

They had found the creature's (tiny) spaceship, after all, and it was clearly the work of a technologically advanced race, although they were at a loss to explain why it was completely automated. Still, it wasn't the type of thing that was likely to have been built by a species with no ability to communicate.

In any case, after that they stopped trying to obtain informed consent and just popped the alien into a CT scanner, which it bore with warbling good grace.

It was a good thing they didn't start with an MRI, Finchi thought when he saw the results. There was something inside the little alien, something egg-shaped and metallic, something that beeped softly if you listened on the right frequency.

Something clicked for him. Finchi called a meeting, the first he'd personally put together, and he showed them slides about the Artifact Hypothesis. Robert Freitas had proposed it, saying that maybe SETI was wrong, that they shouldn't be looking for electromagnetic signals when they searched for sentient life. Said that maybe they should be looking for *things*, physical objects, and the most recent research said that the object wouldn't have to be that big. You could pack a world of information inside a small package, like a metal egg for instance.

With that, the people in charge decided to cut it open. The consensus now seemed to be that the alien was nonsentient; it would peep and burr and snuggle, but it was never going to talk, not their language or any other. It fit with what they had seen of the automated vessel, after all—mice and dogs and chimps had gone into space, but they didn't fly the ship.

Finchi wasn't so sure that this was a good idea. It just wasn't making sense to him—why would the intelligent aliens put their artifact inside a living creature? Plus, the beastie seemed like, well, like such a *pet* to him. It couldn't talk, but it certainly liked company.

He was there when they took it to a veterinary operating room, nice and sterile at least, and he watched as they hooked up the monitors that tracked the beeps and pings of the egg inside it.

They made the first cut, and the egg pinged once, then stopped.

Finchi had a sudden, sickening thought. What if these aliens wanted some information in return?

And what information, if you were in their position, would you want most of all? Do you want to be friends with someone who'd slice open your cat to get your number? This was their failsafe, Finchi bet—hurt the fuzzy and the egg destroyed itself. *That* was a good way to weed out the species you didn't want to meet.

Close it back up, Finchi begged and pleaded and explained, and between that and the silent egg, they were convinced. They took the alien back to the nest they'd built for it, and it wasn't too late after all—the egg began to ping again.

Finchi let out a sigh of relief. Sooner or later, it would lay that egg, he'd bet, and sooner or later, the egg would hatch, and they'd get their information.

It was just a matter of time, all over again. He stroked the little fuzzy's head, listening to the beeps and pings, and he sat back down to wait. ■

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As You Know, Bob

Or, "living up to expectations..."

John G. Hemry

Illustrated by John Allemand

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The agent: How's that science fiction novel you've been working on coming along? Send me an excerpt from the beginning so we can see about getting it into shape for today's market.

The story begins: The phone rang with Bob's signature tune, so Bill tapped the "receive" button. Bob's face appeared, looking unusually enthusiastic, since he normally tried to coast through life with minimum effort. "Did you hear about the frozen Lumpia?"

"Not yet." Lumpia. That sounded important enough for Bill to pause his work and face the phone. "As you know, Bob, frozen Lumpia isn't nearly as good as fresh."

"This stuff is! There's a new process. Meet me in the lobby and we'll go get some and check it out."

Bill's conscience tugged at him. "I dunno, there's this analysis of the signals from the Eridani Probe that I'm supposed to be running. . . ."

"It'll be there when we get back."

"Okay." Bill stood up, powering down his workpad and heading for the door.

In the hallway he met Jane, a researcher who worked a few doors down. Bill tried not to stare as she crossed her arms and looked at him. "You're in a rush. Going on some important mission?" she asked dryly.

"I guess you could say that. I'm going to pick up some frozen Lumpia." Bill hesitated. Jane had the kind of smarts and attitude that had always attracted him, but she had never shown much interest in Bill and had turned him down the one time he had asked for a date. Maybe she would be willing to consider a more casual errand together. "Do you want to come along?" Jane pulled out a money card and checked it, then shrugged. "Sure. Why not? I need to pick up some stuff, too."

The agent: This is okay, but I can't sell it. Something's missing. It's not sci-fi enough, do you know what I mean? This is supposed to be happening in the early twenty-second century and there's nothing about the singularity or nanotech or quantum states or cyberspace or posthumans or multiculturalism or complex antiheroes. How can you call that sci-fi? I know, I know, you've told me that when people use tools they don't think about how they work. But readers expect certain things from sci-fi. Oh, and the characters. Those aren't sci-fi characters. Punch them up and make them the sort of characters you see in *real* science fiction. And get some gratuitous sexual content in there.

The revised story begins: The singularity had crashed and burned in a viral-cataclysm that had destroyed most of civilization and every decent coffee house east of Seattle. Now a complex array of probability states undulated down a fiber-optic line surviving from presingularity days. The electrons carrying the message didn't so much move as they did alter the places where they had the highest probability of existing.

Since the electrons didn't truly exist anywhere, neither did the strange cyberworld in which they didn't move, filtering through an immense alternate reality in which normal physical rules of the macroworld didn't apply.

Entering a complex series of transformational states, the electrons that weren't there interacted with the receiver mechanism, propagating through layered nano-light-emitting-diode projectors to generate a three-dimensional image.

A tune distinct to the originator of the message chimed from the nanomanufactured receiver. It was the First Movement of Genghis Juan Feinstein's folk-rock Hindustani opera, which, William knew, meant the message had to be from Roberto Sigma, the latest in a string of complicated and untrustworthy clone/cyborg hybrids who nonetheless followed their own indecipherable code

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of honor. William moved his palm over a light sensitive but robust section of his desk to command his virtual workstation to pause in its operations. Now as the stacked image displays created a perfect visual representation of Roberto Sigma, William saw that the enigmatic posthuman seemed happy about something.

"I assume," Roberto Sigma began in the Libyan-Croatian accent he had acquired from his last neural-upgrade, "that you are aware of recent developments in microcryogenics."

William nodded, his own implants from his days as a Special Forces commando during the Betelgeuse incursion activating automatically at the sight of his sometime-friend, sometime-enemy. "As you know, Roberto, cryogenics hasn't yet worked to expectations, especially since several promising lines of research were lost when the singularity crashed."

"Ancient history, William! That is so five nanoseconds ago. I know of a means to demonstrate how well the new process works. It originated in Asia. Interested in meeting me to investigate it?"

William hesitated, his implants jangling internal warnings. The last time he had followed Roberto Sigma it had been into an unending maze in cyberspace from which he had narrowly escaped. But if what Roberto was saying was true, he had to know. "I've been working on analyzing signals from the Eridani Probe. It's been using the new quantum state transmitter to tunnel data through to us at amazing speed."

"If the signals have propagated through quantum paths, they will still have a probability of existence when you return."

"You're right. I'd forgotten about the addendums Jonquil made to the Hernandez postulates back in 2075," William agreed. He gestured another command over the light-sensitive control pad, ordering his workstation to shut down and watching as it swiftly cycled through functions and closed them before powering off automatically.

William stood, his lean muscles rippling as the commando implants amplified William's own natural speed and strength. There weren't a lot of former Special Forces commandos doing astrophysics research, so he tended to stand out during the virtual conferences. William walked across the floor tiled with panels from the Toltec/Mayan revival period, nanocircuits in the panels sensing his movement and sending commands to the door, which slid open silently on nanolubricated rails as William approached.

He slipped cautiously into the hallway and saw Janice from a few pods down, the nanoparticles in her lip gloss making it glow a delicious ruby red. Janice spun to face him with all of the pantherish grace you'd expect from a first-degree black belt, her blue eyes watching William speculatively. He tried not to stare back. At twenty-three years old, Janice was the most brilliant and the most beautiful quantum physics researcher in the entire world. What was left of the world after the singularity crash, that is.

Janice crossed her arms, drawing William's gaze to the magnificent breasts that led her hetero-male colleagues to speak admiringly of the amplitude of Janice's wave functions. "You're in a rush. Going on some important mission?" Janice purred.

"You might say there's a high probability of that," William replied. "I need to acquire some samples of a new cryogenic process."

Janice's gorgeous eyes narrowed. "Are you talking about the Renz/Injira process? I understand that freezes organic matter in crystalline matrices that preserve cell structure. When it's returned to normative temperature its composition is perfectly preserved."

"That's what they say. I need to find out if it's true, and there's a certain item

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of Asian origin that will give me the answer." William hesitated, feeling a strong attraction to Janice that had nothing to do with the gluons holding her quarks into such an attractive package. She had once told him that they would never occupy the same space. Did her exclusion principle still apply to him? "Would you like to come along?"

Janice's eyes glowed a little brighter as her nanovision enhancement implants reacted to her excitement. She reached into one pocket and checked the charge on the twenty-gauss energy pistol she carried everywhere. "Sure. I'd calculated there was a high probability of deflection in my plans for today. It looks like I was right."

The agent: Much better! Very sci-fi. But I did notice that the story doesn't seem to flow as well as it used to. Maybe you can fix that by using some of the real cutting-edge concepts. You know, quantum foam and dark energy and stuff. And try to make the characters a little more exotic. You know. Weird. More science-fictiony. Give it a shot and see if you can clean the story up a bit.

The re-revised story begins: Wilyam sensed the arrival of a message from his old rival and comrade Robertyne, who had existed in an indeterminate state since an accident while researching applications in the mysterious world of the quantum foam, where literally anything was possible. Waving a hand to freeze his work in mid motion above his desk, Wilyam waved again to bring up the message display.

Particle functions coalesced into a functional framework, emitting radiation on visual frequencies. The familiar features of Robertyne appeared as if he/she were actually looking at him through a window, though Wilyam suspected that Robertyne had actually ceased to exist some time before, and he was really speaking directly to the inexplicable presence that seemed to animate the quantum foam. The image of Robertyne displayed a very human smile, though even when Robertyne had been unquestionably posthuman, he/she had never been easy to understand or to trust. "Have you heard the ripples in the foam, Wilyam? Organic matter from the macroplace you call Asia now exists in a frozen state without flaw."

Wilyam frowned as the implant linking him to the bare edges of the foam glittered with possible outcomes. He saw himself in a million different mirrors, each one reacting slightly differently to Robertyne's proposal. "As you know, Robertyne, nothing actually exists, so it isn't possible to preserve something that doesn't exist. Previous attempts have produced probability chains that wander off into reduced states of replication quality."

"There's something new/old/past/present/future in this perception reference, Wilyam. It represents a low probability outcome of extreme accuracy."

It sounded tempting to the millions of different Wilyams staring at him from the could-be's dancing around the implant. "I'm busy analyzing signals from the Eridani probe. We're not sure if they're from our probe or if signals are tunneling from an alternate probe in another reality."

"Then split your probabilities and attend to both and neither. I am everywhere and nowhere, but will center a probability node below here."

"Okay." Wilyam focused on the implant, drawing on the strange properties of the quantum foam to create infinite possibilities. He waved a hand to shut down his work and stood up/remained sitting and continued working.

The door's probability state cycled as one Wilyam approached, going to zero for an instant as that Wilyam walked through.

In the endless hallway beyond, Jandyce from a few stationary states down floated with her eyes closed. She

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opened them, her eyes glowing blue from the tap implanted in her brain that connected Jandyce directly to the dark energy that filled the universe. Wilyam tried not to stare, knowing Jandyce was tied into cosmic currents none of his probabilities could hope to grasp.

She crossed her arms, drawing Wilyam's observations to the two symmetrical anomalies superpositioned on her chest, both far exceeding functional limits in a way that excited his ground state and also provided proof that dark energy could overcome the pull of gravity. "You're in a rush. Going on some important mission?" Jandyce hadn't spoken, but her voice echoed in his head.

"The foam has found something new. A way to preserve matter in a hitherto unknown way. There's a sample from the human-reality matrix of Asia." Wilyam hesitated as his millions of selves around the quantum foam link swirled in every possible action-outcome sequence. Jandyce and he usually demonstrated weak interaction. When he had once asked her about the possibility of mutual reinforcement, she had informed him that the likelihood of direct reactions between quantum foam and dark energy was infinitesimally small and shown him the Feynman diagram that proved it. But he had long hoped for a probability sequence that could result in entanglement with her. Perhaps, somehow, their wave/particle dualities could constructively interfere in a way that would generate mutually beneficial patterns. "Would you like to come along?"

Jandyce's eyes glowed brighter as the dark energy flowed. Matter swirled as she reached beside her and plucked a patch of darkness from nothing, examining it closely. "The cat lives. I will go, maintaining the proper balance of forces and perceptions."

The agent: Great! This I can sell. It's pure sci-fi. Nobody could understand what's happening or why these, uh, people are doing whatever it is they're doing. Tell you what, though, it's still a little rough. I mean, how do you explain what's going on? Readers want to know how this stuff works. So how about you polish it a little, provide some explanations, and give me one more look, okay? Oh, and put the sex back in. You didn't take it out? Well, then make the sex *understandable* again. Make the sex so *anybody* can understand it. Heck, make the whole thing so anybody can understand it.

The re-re-revised story begins: The great wizard Wil sensed a message from his companion and challenger the Baron of Basi. He waved one palm and the magical mirror on a nearby wall glowed, showing the image of the Baron, who gave Wil a searching look. "Have you heard? From far in the East, that which we have long sought can now be ours. It lies frozen."

"Frozen?" The Wizard Wil gestured again and the fires blazing beneath his cauldron sank to a low glow. "As you know, Baron of Basi, nothing once living survives well being encased in ice."

"The Grand Council has found a way, I tell you! A way we must investigate before the Bane of Dargoth does! That which we desire lies frozen in a state of perfection. Come down from your tower and we shall seek it together."

"A quest?" The Wizard Wil turned a doubtful look on his cauldron. "I have been seeking to interpret certain messages from the stars."

"Surely a wizard of your powers can deal with two tasks at once."

"There is a way," the Wizard Wil agreed. Calling up the proper spell in his mind, Wil summoned an elemental assistant and ordered it to continue his work. He walked toward the door, the earth spirit bound to it seeing his approach and opening the portal, then closing it behind him.

Outside stood the Sorceress Jainere, who sometimes appeared in the south tower of Wil's fortress. Jainere, her eyes

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glowing with the fires of the powers that lay beneath the world humans knew, sought wisdom in places few dared venture. Now Wil tried not to stare at the beauty she barely concealed behind a few filmy garments, her breasts glowing with a magic older than time that offered the promise of pleasures no man could withstand. The sorceress Jainere crossed her arms under those breasts, smiling enticingly as she saw the reaction Wil could not hide. "You're in a rush. Going on some important mission?" she inquired in a voice that rang like the tiny bells the dancers of Dasiree wore.

"We seek that which was frozen and can be rendered perfect again once thawed," Wil spoke haltingly despite his efforts to resist the spell of Jainere. "It comes from the lands far to the East, where priests and priestesses with skins the hue of the sun have long guarded it." He had desired Jainere for many lives of normal men, but the unpredictable sorceress had always scorned him, declaring that no sorceress could live by the rules of right and wrong that Wil followed. Perhaps if she joined the quest Jainere would finally learn enough about him to desire uniting their powers and their lives. "Do you want to come along?"

Jainere reached down to the slim, bejeweled girdle that hung on her hips in a way that made men's minds go astray, drawing forth the enchanted mirror in which she viewed images of what might be. "Your possible futures are of interest. I will accompany you. It might be amusing."

The agent: Now that's more like it. Fantasy! There's a big market for that now. It's a lot easier for readers to understand than sci-fi and people seem to be able to relate better to the characters.

I wonder why they don't want to read science fiction as much these days? ■

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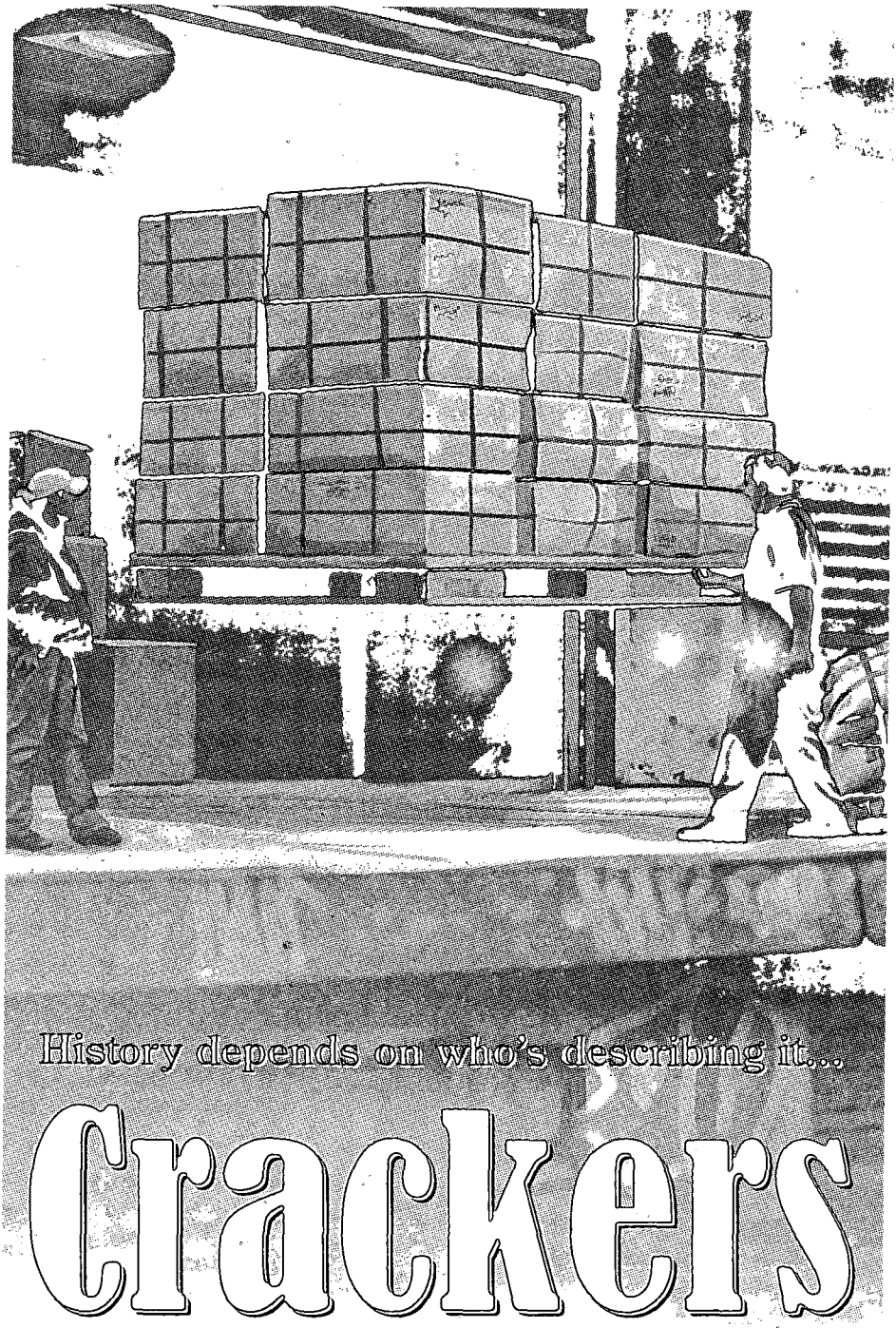

History depends on who's describing it...

Crackers

Jerry Oltion

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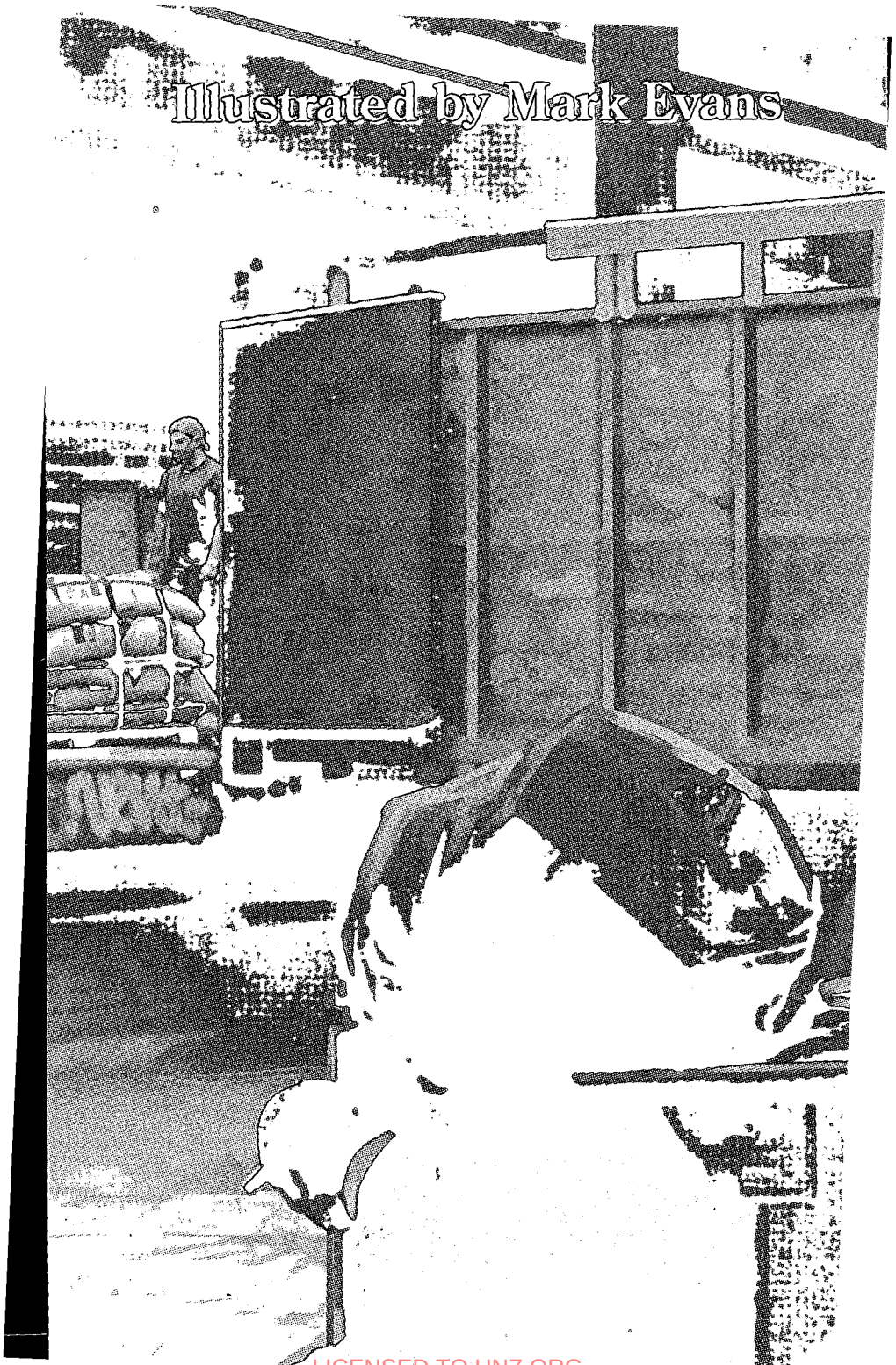

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The bottle-return machine was rigged. Daniel knew exactly how many bottles he had—when you sift through trashcans for enough returnables to buy dinner, you remember every success—but the automated counter outside the Calway store had shorted him by two.

He punched the printout button and waited for the flimsy receipt to slide out of the slot. The printer kicked it out hard enough to fall free, but he snatched it before it could drop more than a couple of inches. He was onto that trick, too. The store manager deliberately set the machines to do that, no doubt figuring that a certain percentage of the receipts would flutter away on a breeze, never to be recovered, and never to be paid, either.

Daniel carefully folded the Tyvek bag he had carried his bottles in and took it inside with him. The bag was worth almost as much as a bottle.

He took his receipt directly to the express-lane checker, a tall, geeky teenager he hadn't seen in the store before. At least he didn't think he had, but it was hard to tell for sure. The kid had the same sculpted hair and wire-frame glasses as every other kid nowadays. Daniel would never have believed *that* fad would return, but apparently it was hip to look like a refugee from the seventies. Probably because these kids hadn't had to live through the original.

The checker gave Daniel the Look when he handed over his bottle ticket. The "Oh, hell, not another homeless guy" look. Daniel saw it on every "respectable" face all over town. As if it were some moral failing to run out of money and wind up living under a bridge. He felt like telling the little pimple factory just how close to Daniel's condition he really was, but he knew the kid would never understand. Neither had Daniel, before the long string of bad luck and bad government that had conspired to wipe him out. He had long since given up trying to explain to people how he'd lost his job because he was putting too much time into developing a force field generator, and how he'd lost his house because he couldn't make the payments without his job and how he'd then had his invention stolen by a gang of teenagers who didn't even know what they'd stolen—who had probably dumped it in one of the very dumpsters that Daniel now sifted through for returnable bottles, and if that wasn't irony then nothing was—and how every government-sponsored program that was supposed to help people down on their luck had been cut for lack of funds, including the state health plan, which meant that he couldn't even get his antiparanoia medication anymore; but he'd learned the hard way that people tuned out after the words "force field" and just treated him like a loony.

Besides, this kid was his chance for fifty more cents if Daniel didn't piss him off. So he just said, "Your bottle machine shorted me by two bottles again."

"It did?" the kid asked.

"It did," Daniel affirmed. "It does it every time. Which should be no surprise, because your manager sets it to do that on purpose."

Usually the checkers just nodded and smiled and gave him his extra money, but this kid said, "I'm the manager."

Daniel stared at him. Nineteen, maybe twenty at the oldest. How the hell could he be the manager? When Daniel was that age and working at the I.G.A., he'd still been stocking shelves.

If he'd learned anything in his years on the streets, it was not to back down when dinner was on the line. "If you're the manager, then you're just the person I want to talk to," he said. "The bottle machine fails to credit one in every thirty or so, and it does it consistently. I've complained every time, but it still happens. Which leads me to believe that you're doing it on purpose."

The kid said, "What, you think there's some kind of dial inside the machine that lets you select how many bottles to

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skip per hundred?"

"There must be. It's too consistent to be an accident."

The kid looked at the ticket, then back at Daniel. "If you think that, then why do you keep coming here?"

"Because this is the closest store to my cardboard box," Daniel said. "And it costs seven fifty to ride the bus. That's thirty bottles. Thirty-one if I run 'em through your machine."

The kid looked like he might argue some more, but two college girls walked up behind Daniel and set a bottle of wine and a brick of cheese on the conveyor, and suddenly he was all smiles. "Okay," he said. "Thanks for bringing that to my attention. I'll look at the machine and see if I can figure out why it's doing that." He rang up Daniel's fifteen dollars and twenty-five cents from the ticket, plus an extra fifty cents for the two bottles the machine hadn't counted. The change machine beside the check-writing stand spit out three quarters, and the kid handed Daniel three fives from the till.

Daniel took the money without comment. He went around the end of the check stand and back into the store to see what he could buy for fifteen seventy-five.

It turned out crackers were on sale. Just the store brand, but he could get a two-pound box for nine ninety-five, which was still highway robbery, but it left him with enough to buy five packs of ramen noodles and a couple of apples. Daniel hated noodles, but they were cheap and filling, and five packs would do him for a couple of days. If nobody stole them in the night, he wouldn't have to scrounge for bottles tomorrow.

He almost didn't get the apples. The price was right, but they were in a stack so improbably high and steep that he was afraid to take one even from the top for fear of bringing down the whole pile. He could wind up kicked out of the store for good over something like that, which would mean having to find a new neighborhood to scrounge and shiver in. Daniel didn't exactly love his cardboard-lined bridge abutment, but it was better than a park bench. He wanted some fresh fruit, though, and all the produce bins were piled up like the apples, so he screwed up his courage and lifted the top two off the pile as gently as his shaking hands would allow. His fear lent him strength; the apples hardly weighed a thing until he got them free of the pile, but as he backed away it felt as if they gained weight until they were heavy as normal. Odd how the body reacts to stress, he thought.

He took his groceries back to the same checker, who ran them through the scanner while Daniel unfolded his Tyvek bag and packed it himself. "Remember the twenty cents for the bag," he said when the checker was done.

With a theatrical sigh, the checker deducted twenty cents from the total, which left Daniel with exactly fifty cents.

"Guess you didn't need those two bottles after all," the checker said.

Daniel pocketed the quarters and picked up his bag. "Live on the street for a year and then tell me that."

He left the store without looking back, and walked the block and a half to the vacant lot where he hung out on warm days. Today had never gotten really warm, and it was just an hour or two short of twilight, but at least it wasn't raining, and the thought of food had set Daniel's stomach growling hard enough to hurt. He would cook up some noodles when he got back to his camp under the bridge, but he could have an apple and some crackers right now.

There were a lot of planes in the sky today. His vision wasn't good enough to let him see their wings, and his ears were apparently going south, too, because he couldn't hear any engines, but he could see stuff moving up there that was way too big for birds. He felt a little like a bird himself, settling into the little

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nest he'd made behind the blackberry thicket at the back of the lot. He took one of the apples from his bag and bit into it, being careful to chew on the side of his mouth that could still handle something that crisp. Mmm, that was sweet. He wanted to down the whole thing in three bites, but the crackers would be dry, and he needed that apple to help wash them down.

The box was glued together like a kid's school project, but he pried it open carefully so he could reclose it again. Even when the crackers were gone, the box could prove useful. They were apparently making them out of some kind of plastic these days, and a guy who lived outdoors appreciated plastic.

He opened one of the four rectangular packages inside with equal care, and reached in for a handful of crackers, but his fingers encountered only powder and crumbs.

Had he opened the bottom? No, that wasn't the problem. The entire package was crushed. All four of them were. There wasn't a single intact cracker in any of them.

"Son of a bitch," he growled. This just wasn't his day. Was this some new kind of deal for people who wanted to make cracker-crumb piecrusts or something? He looked to see if the box said "pre-crushed" anywhere on it, but it was just a regular cracker box. He poured a pile of crumbs onto his palm and tipped them into his mouth. They tasted okay. He supposed they would be just as nutritious this way as if they were whole, but damn it, he'd been looking forward to actually *eating* them, not just pouring them down his throat.

The store wasn't that far away, and he still had his receipt. And that snotty little manager needed to know he couldn't get away with crap like this.

He wrapped up the rest of his groceries, tucked them under the blackberry bush for safekeeping, and headed back to the store. He ate the rest of his apple on the way back, spitting out the seeds and the stem before he went inside. The boy manager looked surprised to see Daniel again, and wary, but his expression grew hard and cold when Daniel showed him the box of cracker crumbs.

"You got these out of the dumpster," he said.

"I bought them not half an hour ago," Daniel replied. "You sold them to me yourself. Here's the receipt."

The manager didn't even look at it. "Oh, yes, you bought *a* box of crackers half an hour ago, but only after you found the crushed ones in the dumpster. You figured you could return the crushed box for another good one. Maybe multiple times if you went to different cashiers, eh? Very clever. But not quite clever enough."

Daniel was used to people calling him crazy, but he wouldn't stand for being called a thief. "Look here," he said, waving the box in front of the manager's nose. "The outside of the box isn't even smudged. This has never been near a dumpster." He pulled out one of the unopened packages of crumbs. "These are crushed inside the wrapper, and the wrapper isn't even creased. That had to have happened at the factory."

The kid snorted. "Yeah, right. I'm sure they go around packaging up crumbs just to get at people like you."

That was the last straw. "People like me?" Daniel shouted. "What the hell do you mean by that? You got something against physicists? Or is it a political thing?" Two teenagers with a cart full of groceries hurried past, carefully avoiding eye contact.

The manager blinked stupidly for a moment, then said, "I'm sorry, sir, but I'm going to have to ask you to leave the store."

Daniel felt a chill at those words, but he was well beyond caring. "Not until I get a decent box of crackers for my money," he said.

"No," said the kid, and he crossed his

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arms in a gesture that Daniel knew from long experience. This was the "I'm done with the crazy person" gesture. It usually led to the "I'm calling the police" gesture. And Daniel was all too familiar with the sort of gestures the police used on homeless people.

So Daniel gave the manager the "Up yours" gesture, grabbed his cracker crumbs, and left the store.

He walked straight away from the door until he reached the street, then turned to the right and around the back. The manager thought Daniel had gotten his crushed crackers out of the dumpster, did he? That implied there were boxes of crackers still *in* the dumpster. Even if they were crushed, they were calories.

There were no trucks in the loading dock, and the doors were all closed, so he headed straight for the dumpsters. Sure enough, there in the middle one were dozens of boxes of crackers. They were pretty banged up from all the stuff thrown in on top of them, but they were still okay. There were also a couple of oranges that probably weren't toxic yet, and a hundred or so bags of yellow powder that had apparently been thrown out merely because they had been packaged wrong. The bags all said "tortilla chips," but the stuff inside was fine as flour.

Or maybe crushed chips. Daniel tore open one of the bags and poured a little of the powder onto his palm, then cautiously dipped his tongue in it. It didn't taste like much of anything at first, but as the moisture in his saliva hydrated the powder, it tasted more and more like salty corn.

Crushed crackers and powdered tortilla chips. Normally he would be dancing in glee at this much edible food still sealed in airtight bags, but this was too bizarre. Something strange was going on in this store.

He saw motion off to his right, and raised up to see a semi pulling in off the street. It was too late to hide, but fortunately he had the perfect camouflage. Nobody noticed a homeless guy rooting through a dumpster.

He watched the truck back up to one of the loading bays. The garage-style door rolled up and two teenagers from the store came out to talk with the driver and open up the back of the truck. Daniel expected them to start hauling pallets of groceries out with a forklift dolly, but one of the kids entered the trailer with a blinking electronic gadget in his hand and a moment later came back out carrying an entire pallet of sugar sacks as if it were no heavier than an economy-sized package of toilet paper. He disappeared into the store with it, then came out with the gadget again.

Daniel's heart began pounding. He recognized that gadget. He couldn't see it all that clearly, but he knew what it had to be. His force field generator!

The manager suddenly appeared in the doorway, and Daniel turned back to the dumpster, but he clearly heard the manager say, "Let me see that thing a second. Uh-huh. What's this tape for?"

One of the other kids said, "I, uh, dropped it, and the case cracked, so—"

"Oh, I believe the case cracked," said the manager. "When you pried it open. You were playing with the field strength again, weren't you?"

"No, I—"

"I just had someone return a box of crackers that was crushed to powder without damaging the box. You're telling me the lifter did that without modification?"

"It must have," the kid protested, but it was clear he was lying.

The manager said, "Look, this is not a toy. Use it the way it was designed or find another job."

Ha, Daniel thought. Use it the way it was designed. The kid had no idea what he had stolen. He thought it was some kind of antigravity generator. And with the typical imagination of a two-bit thug, he had put it to use in the most mundane way possible.

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Daniel edged around the dumpster until its bulk was between him and the loading dock, then when everyone was facing into the trailer he walked away, head down so he wouldn't be recognized. He went around to the front of the store and inside, walked down the long produce aisle, and stuck his head cautiously through the swinging doors into the back. The manager was gone, but the other two kids were still unloading the truck, adding pallets full of goods one at a time to the stack against the wall.

Daniel slipped into the storage room and ducked behind one of the pallets. There was a gap between the shrink-wrapped bags of sugar and the wall, so he squeezed into it and climbed up the sugar bags until he could see over them and settled in to wait while the kids finished unloading the truck.

It didn't take long. Using the force field generator as an antigravity device, the kids hauled pallet after pallet out of the trailer as easily as they might have unloaded a shipment of pillows. Daniel kept his eyes on them while they pushed the last pallet into place and switched off the gadget, then put the electronic device on a high shelf between a gallon can of floor wax and a box of Magna-ties, whatever those were. The kids had put it in a fancy box, but he knew it was his force field generator. It was the right size, and what they were using it for couldn't be done any other way. That was Daniel's life work, casually dumped there by a couple of teenage goons who probably didn't even realize that antigravity was supposed to be impossible.

The driver gave the two kids a handful of paperwork, then climbed in his truck and drove away. The kids rolled the door shut, and one of them took the paperwork into the store while the other set to work slicing open the clear film that held the last pallet of stuff together.

Daniel had hoped they would both go back inside and leave him alone in the storage room, but it didn't look like that was going to happen anytime soon. He could have waited until the store closed except for one small but increasingly important detail: apple juice always made him pee, and he had eaten a big apple not long ago. His need wasn't urgent yet, but it would be in another fifteen minutes or so, and he might need that time for running if things went badly.

He could handle one teenager. And with the force field, he could handle any number of them. They wouldn't get the drop on him this time. He rehearsed the steps in his mind: jump down, cross the width of the room to the shelf where they had put his device, grab it, flip it on, and head for the door at a dead run. These kids might be using it for lifting, but he knew how it really worked: the outward-pushing force field would protect him from the impact, so he could plow right through the door's flimsy fiberglass panels if he kept his speed up. The kinetic energy of the whole system was still $1/2\ mv^2$, after all.

He took a deep breath. That first jump was going to be the worst; it was at least seven feet down to the concrete floor.

He swung around so he would land feet first and slid over the edge. The kid either saw him or heard him, and let out a startled "Hey!" just as Daniel hit the floor, but Daniel was too busy grunting "Oof!" to respond. He rolled to his feet and rushed for the device, but knocked over the can of wax instead, which fell off the shelf and landed on his left foot.

He cursed and leaped back in pain, knocking over the kid, who had rushed toward him. Daniel kicked the can of wax aside and grabbed the device, fumbling for the switch even as he ran for the door. The feeling of his invention in his hands again after all this time was like a drug, better than a drug, better than sex or even a good meal. He held it next to his center of mass while he found the power switch and flipped it on—

—and a giant hand grabbed his in-

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sides and squeezed. At the same time, his last step sent him flying into the air like an astronaut on the Moon, bounding forward ten feet before coming down again. It was too late to stop, so when his feet touched down again he kicked forward as hard as he could, adding one last step to his momentum toward the door. Trouble was, the kick sent him flying more upward than outward, and he completely missed the door, smashing into the wall above it instead.

The force field protected him from the impact, but that hardly mattered. The field's effect on his insides was worse than running headlong into a wall would have been. Daniel knew exactly how his crackers had gotten crushed, and how the corn chips had been turned to powder inside their bags; his internal organs felt as if they might do the same . . . starting with his bladder. He felt the wetness spread through the crotch of his pants as he fell to the floor.

What had the damned kids done with his force field generator to make it behave this way? They must have increased the power by an order of magnitude, and tweaked the tuning circuit to push inward as well as outward. Not a bad modification, actually. That would isolate whatever was inside in its own bubble of gravity-immune space. He would have thought of that on his own if he'd had more time to test the device before it had been stolen from him.

But the modified field had one serious drawback: the thing was trying to kill him. Even moving his thumb was a struggle, but he managed to flip the switch before the force field was quite able to squeeze him into his own navel. His full weight pressed him into the concrete floor. He gasped for breath with lungs that were suddenly free to move again.

The kid knelt down beside him. "Dude, that looks like it hurt. Are you okay?"

"No, I'm not okay," Daniel croaked. "Call an ambulance."

The kid stood up and ran for the double doors into the store, and Daniel tried to get to his own feet and beat a hasty exit while he was gone, but something definitely didn't feel right inside. He managed to stand, but only by leaning against the wall, and every step toward the door was agony. He at least stuffed the device into his pants, figuring nobody would investigate there, not as soaked as he was now. He hoped none of that wetness was blood, but he couldn't tell by feel and he couldn't bring himself to look.

He heard running footsteps, then the double doors banged open and all three kids rushed in.

"What's going on here?" the manager demanded.

"Did you call an ambulance?" Daniel wheezed. He had no insurance, but he knew the hospital had to take him if he was actually injured.

"No, I didn't call an ambulance." The manager took a couple of steps closer, but he stopped when the smell hit him. "God, what did you do, piss yourself?"

"I tried to retrieve what's mine," Daniel said with as much dignity as he could manage.

"What, the lifter?" the manager asked. Then he laughed. "You're nucking futs."

"He's off his meds," one of the other kids said. "And now I think he's really hurt, too. We ought to get him to a hospital."

"Not in an ambulance," said the manager. "Not from here. You bring an ambulance to a grocery store and before you know it you've got rumors about food poisoning."

"What do we do, then?"

"You take him to the emergency room in your own car if you want to help him so much."

Even the compassionate kid had his limits. He looked at Daniel's face, then at his pants. "He'll get my seat wet."

"I'll be even more of a hassle if I die right here in your stock room," Daniel

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said. His legs couldn't hold him anymore; he slid down the wall and landed hard on his butt.

"Put some plastic bags down before he gets in," the manager said.

"No," said the other kid. "Just call the friggin' ambulance, and tell 'em to come around to the back."

"If we call, it goes on our insurance."

"If he dies, that goes on our conscience."

"God damn it," Daniel bellowed, or at least rasped as loudly as he could manage with his bruised lungs, "would somebody just make the fucking call?"

The kids backed away from him and continued their argument in loud whispers, as if he couldn't hear them as long as they didn't want him to. He didn't care. They seemed to have forgotten about his device, and that was the important thing.

He tried to stand again, but a sharp lance of pain shot up his back and he collapsed back onto the concrete with a loud groan.

"All right, all right!" the boy manager said. "Just make sure he lives until they get here." He stomped off, leaving the other two kids with Daniel.

"He's, uh, he's calling the ambulance," said one.

"Can we get you anything?" said the other.

Daniel shook his head. He wanted to say, How about my life back, you thieving little punks? How about some compensation for the years of homelessness? How about some justice? But he couldn't remind them of the generator. He couldn't find the breath to say anything anyway. It was all he could do to gasp for enough air to keep the swirling tracers in his vision from expanding to fill his entire field of view.

It seemed to take weeks for the ambulance to arrive, but eventually the kids rolled up the door and a couple more kids rushed in with a stretcher, which they laid beside him.

"You're going to be okay," one of the new kids said as they lifted him as gently as they could and laid him on the stretcher.

"Do you even know first aid?" Daniel asked.

"Huh?"

"You can't be over fifteen," Daniel said. "What is this, career day at the high school or something?"

"Fifteen?" asked the medic. "What? I'm forty-six."

"Yeah, right," said Daniel.

"He's kind of messed up," one of the grocery store kids said.

"We'll help him get better," the medic said. "Ready?"

"Ready," the other medic said.

Daniel heard something click near his head, and the stretcher rose into the air, bobbing gently like a boat on a river. The medics guided it into the ambulance, which floated just at the right height for loading, despite being much smaller than a delivery truck. It dipped a little under their weight, but quickly steadied out, and a moment later it lifted straight up and flew away over the store's roof.

Daniel strained to hear the rotors, but he knew he wasn't in a helicopter. Somehow, some way, the ambulance was flying in perfect silence, without an engine of any sort. Out the window, several other vehicles swept past at various altitudes. They weren't planes. They weren't planes.

One of the medics poked a needle in his wrist, and a screen above the window lit up with numbers. "Wow, you've got some weird chemistry goin' on," the medic said. "It may take a couple minutes to clear it out."

Clear wasn't the word Daniel would have used for it. His head felt like his abdomen had felt earlier: as if some force were squeezing it, forcing the part of his mind that contained his world into a smaller space, making room for a much bigger world, a world that contained air cars lifted by artificial gravity, which was just one of many spinoffs from the force

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field.

"I invented this," Daniel said, more to himself than to the two medics in the ambulance with him.

"Invented what?" one of them asked.

What, exactly, had he invented, anyway? His mind was a muddle of memories and paranoid dreams, all shuffled together through the fingers of time. He had invented a force field, that much he remembered clearly. And it had been stolen. But apparently that was long ago, and whoever stole it had known enough to do something with it. Daniel knew he should be angry, knew he *would* be angry, angry enough to track that person down and regain the credit he deserved if he ever got the chance, but at the moment his mind was too full of wonder to hold any other emotion.

"He's drifting," someone said.

"Keep him focused."

"Sir? Sir? What did you invent, sir?"

"The future," Daniel answered. "I invented the future." ■

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THE ALTERNATE VIEW Jeffery D. Kooistra

BASEBALL AND HURRICANES

For the first time in nineteen years, my beloved Detroit Tigers are going to the playoffs. Since I'm writing this in late September, I have no idea how they will do once they get there, but just making it to the playoffs is a huge achievement for a team that only a few years ago lost 119 games.

One reason the Tigers have had such an exceptionally good season is because of the arm of their rookie fireballing relief pitcher Joel Zumaya. Joel routinely throws fastballs in the 100 miles per hour range. At least once he hit 103—for that he was featured on a Comcast high speed Internet commercial. When he comes in to pitch, and he's got his stuff, batters go down on strikes.

I ordinarily watch the Tigers on the local Fox Sports affiliate, which has a pair of announcers who follow the team. But now and then a game is televised nationally, and recently one was shown on ESPN 2. On that announcing team was Joe Morgan, the hall of fame second baseman from the World Champion Cincinnati "Big Red Machine" Reds of the 1970s. Not only was he great at what he did then, but he's great at what he does now, having won Emmy awards for his broadcasting skills. However, while I was watching him, he ran afoul of me.

You see, Zumaya came into the game, and, as usual, the radar gun was showing him throwing pitches of 100, 101, even 102 miles per hour. But Joe Morgan didn't think the pitches were that fast. And he claimed he could tell this from the broadcasting booth. He pointed out that home teams sometimes alter their radar guns to make them read faster, neglecting to note that Zumaya throws his fastballs in opposing team stadiums as well, and their radar guns also show him pitching at 100+ mph. Morgan even claimed he could tell the difference between a 100 and a 101 mph pitch.

So there I am, watching TV, wanting to shout at the screen: "How can you tell that, Joe? When was it you compared a 100 mile per hour pitch with a 101 mile per hour pitch? How did you know the speed of either one of them? Did someone tell you? How did *he* know? Was a radar gun present, or some other way to make the measurement? Did you do this often enough so you could acquire the skill to reliably discriminate the faster pitch from the slower? And from a broadcasting booth? *Hmmm?*"

I don't suppose there's anything to be gained by pursuing the issue with Joe Morgan. If he's willing to dispute what the radar gun says, and do it on TV before a national audience, he isn't going to listen to me. He expected his listeners to believe him when he said he could distinguish a real 101 mph pitch from a slightly slower one. After all, why shouldn't we believe him? He's an expert, right? He's in the Hall

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of Fame. What more do you want?

Well, this is the Alternate View, and I want a lot more. I think his claim is easy to undercut. The Achilles Heel of any suspect claim is usually a faulty comparison, so let's find it.

It seems reasonable to assume that sometime in the past Joe Morgan faced pitchers who were said to have a 100 mph or better pitch. And during his broadcast career, he's seen other pitchers with 100+ mph fastballs, too. I doubt Joe just manufactured his assertion out of thin air, so he must be comparing what he remembers those pitchers throwing with what he sees from the booth, and making a judgment. Specifically, he has an image in his mind of what a true 101 mph pitch looks like, and judging that what Zumaya was throwing was slower than that.

My unshouted questions go to the heart of the matter—how does Joe Morgan know that what he sees in his head is accurate?

Suppose you wanted to develop the ability that Joe Morgan claims he has. What should you do?

One thing you could do is go to a baseball diamond and have a pitching machine set to throw 100 mph pitches at you. Then you could set it to thrown 101 mph pitches. You should have a radar gun around to verify that the pitches are in fact at those speeds. Make sure you have the radar gun properly calibrated beforehand, and double-check the calibration afterwards.

Once you've gotten some experience with the 100 and 101 mph pitches, you could have someone randomly change the speed of the pitching machine to either value, and then, once you see the pitch, you could try to accurately predict what the setting was. Do this often enough, and perhaps you could develop the ability to accurately distinguish a 100 mph pitch from a 101 mph pitch.

Suppose you get to the point where you can accurately tell the difference between the two pitches 90 to 95 percent of the time. What then? Well, if you want to be as good as Joe Morgan, you should go up to the broadcasting booth and see if you can still get the right answer 90 percent of the time. If not, keep practicing until you do.

Now are you ready? No. Not all broadcasting booths are created equal. You really need to situate yourself at all kinds of different positions with respect to the pitching machine, enough so that you develop the ability to distinguish between the two pitches regardless of where the broadcast booth is in a stadium.

Do any of you think Joe Morgan ever did anything remotely like this? No? Me either. This doesn't prove he *can't* do what he says, but there is ample reason to doubt that he can.

The reasoning I used to undercut Joe Morgan's claim can (and probably *should*) also be used when ascertaining the likely validity of all sorts of other suspect claims involving comparisons, including scientific ones, even if you're not an expert. Particularly susceptible are those claims of the "it's never been this bad before" variety.

Here's a for instance. Last year the US went through a bad hurricane season. Claims were made that 2006 would bring another terrible hurricane season. In the "Instant Expert" section of *Popular Science* (July, 2006) on pages 66 and 67 (attributed to Elizabeth Svoboda), readers were told, "Why 2006 Will Be So Stormy." Some experts claim that global warming is to blame. More precisely, claims are made that hurricanes are worse now, on average, both in number and intensity, than they ever were before.

So far, with October looming, this hurricane season has been a real bust. What went wrong?

The problem doesn't lie with Moth-

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er Nature—she knows what she's doing. We all know weather predictions can be terribly wrong even when made only a day before, let alone a year. Most experts on hurricanes have long predicted that the US would enter a bad stretch of increased hurricane activity during the present decade, based on records of previous cyclic hurricane behavior, without reference to global warming at all. So to assert that 2006 would match 2005 wasn't unreasonable. It just so happened that a severe year was followed by a mild one this time.

But are hurricanes actually getting worse, on average, "than ever before?" Can we even tell?

On page 67 of the aforementioned *Popular Science* piece, it says: "And storms *are* getting stronger." The reader is then referred to a bar chart inset on page 66 showing the percentage of category 4 and 5 hurricanes in five-year wide increments since 1970. In the 1970-74 slot about 15 or 16 percent of hurricanes were in category 4 or 5. The bars covering 1990 through 2004 all show over 30 percent.

Let's consider this bar chart. For the chart to prove the "worse" hypothesis, we need to know how many hurricanes were averaged in the past, and how strong they were. Since we're working with averages, we need to be able to use data that goes back pretty far into the past. There's nothing special about 1970, so why does the chart begin there? "Ever before" is a long time.

Since hurricane patterns are cyclic, and since the present period was expected to be hurricane prone based on that cyclic behavior, it is no surprise that hurricane intensity was lower in the previous few decades. It also follows that hurricane activity must have been greater prior to 1970. However, if hurricanes really are getting worse, then the average numbers and intensity of hurricanes during the pre-1970 high parts of the cycle must not have been quite as many nor quite as intense.

These days, what with our satellites looking at the Earth every second, we know where every hurricane is at any given moment, and even where a hurricane might develop. We can send airplanes in to take measurements, and take those measurements with very accurate instrumentation indeed. We have gotten much better at this since the '70s and '80s. Prior to those decades, we were in the Stone Age of hurricane study.

What did we rely on before we had satellites? Reports from aircraft and ships. But how accurate were those reports compared with what we have today? How reliable was the instrumentation? How well can readings taken then be calibrated with readings taken now? If, in reality, there were twenty hurricanes in a given year, were twenty hurricanes reported? Or did some occur in places where they were missed? Today we can watch a tropical storm turn into a hurricane for a day and then decay back into a tropical storm, essentially in real time. How would that same storm have been classified if it had never been observed as a hurricane? If it didn't hit an island or no ship encountered it, we'd have no idea at all that part of its life was spent as a hurricane, would we?

It may indeed be the case that hurricane seasons are getting worse due to global warming, but the hurricane chart can't tell us that. It is simply not valid to compare the numbers and strengths of hurricanes we know about today, measured and assessed by modern means, with numbers arrived at decades ago. The only thing we can be fairly certain about is that the methodology available in the past would have tended to underestimate the actual number of hurricanes in a given year.

The hypothesis that hurricanes are

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getting worse is worthy of investigation. To do it right, one could start with data obtained from the 1980s or '90s, and then keep taking data for the next hundred or hundred and fifty years. Then you'd know that no hurricanes had been missed in any given year, and that you'd also accurately classified their respective intensities. Even if the criteria for classification should change during the next century, you'd probably still be able to reclassify the storms of today with those of tomorrow because we're able to collect and store so much data these days. Then you could put together a bar chart that even I would believe.

But accept that hurricanes are "worse than ever" on the basis of the chart Ms. Svoboda provided? Shoot, she might just as well have said, "Because Joe Morgan says so." ■

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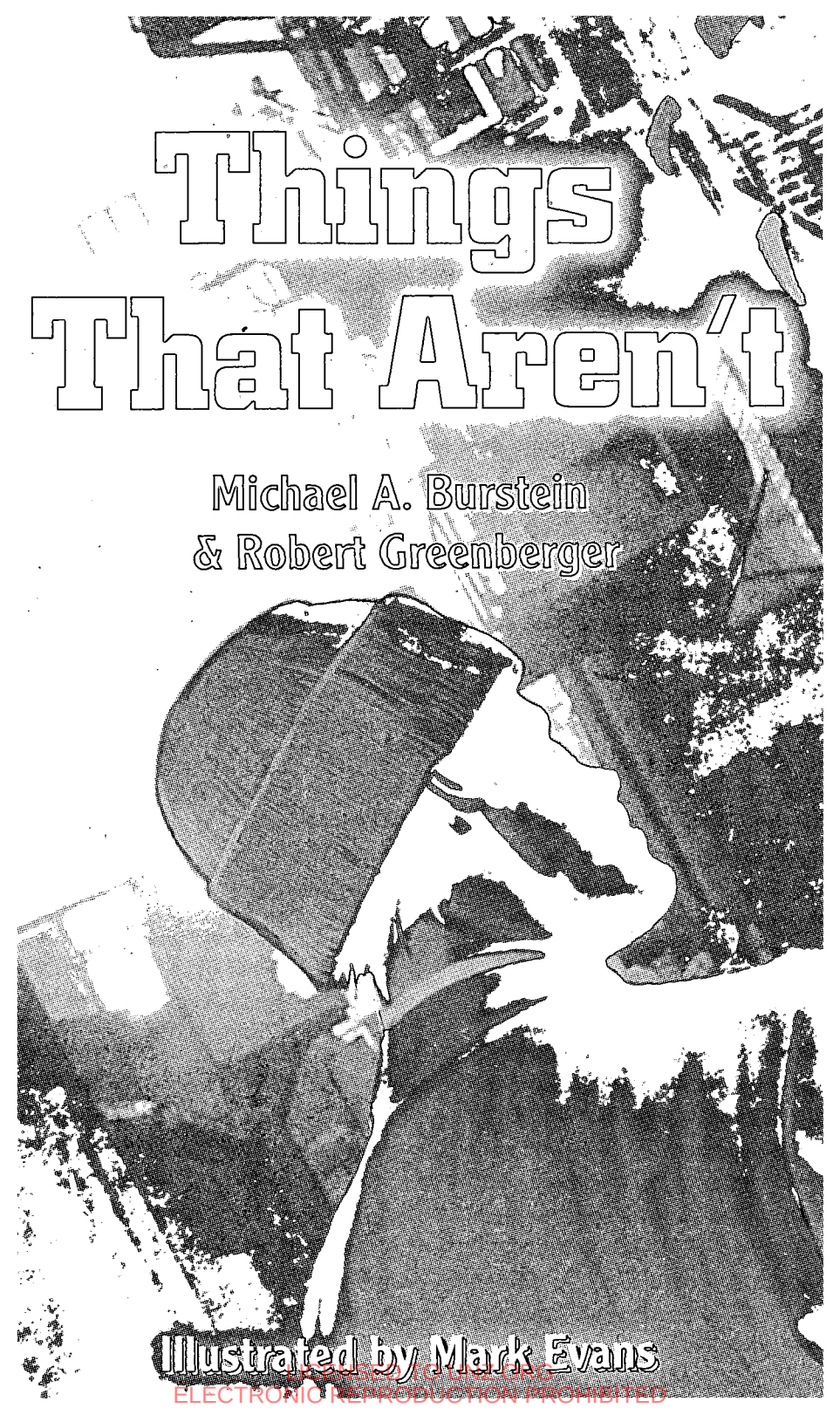

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John Kiradi had just finished crossing 116th street at Amsterdam Avenue when he won the Nobel Prize.

A moment before, he was returning to his Pupin Hall office at Columbia University from having eaten lunch at V&T Pizzeria, a few blocks to the south. Suddenly, he found himself standing at a lectern in Stockholm, about to address an auditorium full of people.

His clothing felt different, and he looked down to see himself dressed in white tie and tails. A heavy round gold medal hung on a ribbon around his neck. He lifted the medal and studied it; the familiar profile of Alfred Nobel glinted in the light.

"Ah . . ." he said. Everyone stared intently at him, waiting for his next words. Confused, he tried to recall the last few minutes. *Wasn't I just at Columbia?*

But this room felt all too real. He rubbed his sweaty palms along the rough wood of the lectern. He smelled the humid air, tasted the dryness in his mouth. And then it all came back to him, in a sudden flash of memory. Kiradi remembered everything; his research had gone much more quickly than he had anticipated, and the Nobel Committee had taken note almost immediately. He was really here, in Stockholm, accepting the Nobel Prize in physics. He smiled, looked down at his notes, and began to give the speech he had labored two weeks in perfecting.

John Kiradi was the happiest he had ever been in his entire life.

Trevor watched John Kiradi fall over, sprawled at the corner of 116th street and Amsterdam Avenue, his hazel eyes staring into space. Trevor tucked the device out of sight, and with a twinge of sadness, walked away from the New York City lunch crowd that was just now noticing the obviously ill man. *One down,* he thought. *Two more to go.*

Arthur hated hospitals.

He hated the antiseptic smell that pe
meated the corridors. He hated the fluo
rescent lighting that turned people'
faces pale as he walked past them to th
elevators. He hated the claustrophobi
he got in patient's rooms.

But Rachel Rotstein, head of the FBI
Special Investigations unit, had sen
Arthur to New York City to assist the po
lice with an investigation so secret tha
she wouldn't give him details before h
left. Arthur would have preferred it if hi
boss had referred the case to the Nev
York bureau, but she had said they neec
ed his expertise for this matter. So it fe
on Arthur's shoulders. Lucky him.

The elevator rattled open on his floo
Arthur found the nurses' station and wa
directed to a room being guarded b
two police officers. As he approached
he flipped open his worn leather cas
and showed them his badge.

"Arthur Valiquette, FBI."

One of the officers nodded. "Detec
tive Jerry Bancroft is expecting you,
she said, pointing to the end of the hall
"He's in the lounge."

He found Bancroft sitting in a molde
plastic chair, reading *The New Yor
Times*. Arthur studied the man; husk
but not fat, hair and mustache definitel
salt and pepper in coloring, well-tailore
suit but not expensive.

Arthur extended his hand. "Arthu
Valiquette," he said.

"Jerry Bancroft," the other ma
replied, his voice deep and authorita
tive. "Call me Jerry."

"I'm Arthur." Arthur felt underdresse
in his off-the-rack suit, already rumple
from the Amtrak train ride. Not that h
cared, but he knew comparisons woul
be made.

"I appreciate your coming all the wa
from Washington to help us out," Jerr
said.

"You're welcome. But may I speal
frankly?"

Jerry eyed him curiously. "Certainly."

"I'm a little surprised that One Polic
Plaza let you request help from th

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Feds."

Jerry shrugged. "Yeah, well, not all of us believe in turf wars, especially not me. I believe in whatever will help me solve a case."

Arthur nodded. "Ah, an enlightened attitude."

"Thanks. So have you been briefed yet?"

Arthur shook his head. "Nope. I was told that the detective in charge wanted to talk to me in person. I take it that's you?"

Jerry nodded. "That's me."

"So what's going on that you needed to pull me away from Washington?"

Jerry looked grim. "We've been trying to play this case as close to the vest as possible. The tabloids still haven't picked up on it, but it's only a matter of time. When they do, it'll be all they'll talk about twenty-four/seven."

"What's a matter of time?"

"Chum for the conspiracy nuts." Jerry sighed. "Come on, I'll show you."

Arthur followed Jerry back to the door being guarded by the two police officers. They entered the room and stopped just inside. A black man lay on one of the two beds. From the gray in his tightly curled hair, Arthur guessed the man was in his mid forties. Next to him a monitor beeped softly every few seconds, and an IV stand stood with a tube leading into his arm.

"Meet John Kiradi," Jerry said softly.

Arthur walked over to the edge of the bed. Kiradi stared at the ceiling, his mouth fixed in a wide smile. Every few seconds he would blink.

"Hello?" Arthur said. He waved his hand in front of Kiradi's face, to no response.

He looked up at Jerry. "So, what's his story? Catatonia? Coma?"

"Sort of. According to the doctors who've examined him, however, it's not like any other coma they've ever seen."

Arthur's expression darkened. He now knew he'd be in this hated building more than once. "Explain."

"I'm not really the expert here, Arthur. But from what I understand, his EKG—is that right?"

"EEG, if you're talking about brain waves," Arthur said. "Electroencephalogram. The EKG is for hearts."

"Yeah, that. Well, his EEG is normal, and the doctors are puzzled."

"What do you mean, 'normal'?"

"Do you know anything about brain waves?"

"My background is mostly in physics, with a little psychology thrown in," Arthur said, and then he smiled. "I leave brain waves for the ESP division."

Jerry gave him a look that said he wasn't sure how serious this federal agent was. Arthur wasn't going to elaborate.

"Well, let me explain it the way the doctor explained it to me." The detective pulled out a little dog-eared notebook from a back pocket, turned back a few pages, and cleared his throat.

"The EEG of a typical coma patient is apparently different from that of someone who is awake. According to the doctor, Kiradi's EEG shows high activity. Normally, an awake person experiences alpha waves and beta waves, with beta representing a more active mind. When asleep, the brain experiences delta waves. Finally, there's something called theta waves which are usually only experienced in moments between waking and sleeping." Jerry looked up. "With me so far?"

"Yeah, but it seems rather simplistic."

Jerry rolled his eyes. "Simple for you, maybe. Anyway, if Kiradi were in a normal coma, he'd be experiencing only theta waves and delta waves. But in fact, he's exhibiting the brain wave pattern of someone who is awake for sixteen hours out of every day and asleep for the other eight."

"So, alphas and betas for sixteen hours, with deltas the rest of the time?"

"You catch on quick."

"So his brain activity is normal. Isn't that good?"

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"It would be good if he were responding to the world around him. But he's not. In fact, there's no explanation at all for why Kiradi is in a coma. According to the doctors who have examined him, he should be up and awake."

"Okay, so why call me in?"

"Two reasons. First of all, Kiradi's not the only one displaying these symptoms. Come with me."

Arthur followed Jerry to the next room over, which was occupied by a blonde woman in the same condition. "This is Karen Daugherty, third-grade teacher. And in the next room is Sylvester Chang, a freelance illustrator. Same symptoms, down to the active EEGs."

"Holy shit." Arthur peered at the woman, studying her face, as Jerry stood by passively. He checked her eyes; the pupils seemed rather large given the lighting in the room.

"Common denominators?" Arthur asked.

Jerry replied, "Nothing obvious. Different jobs, different medical histories—"

"Is it a disease? Some sort of mutated virus?"

"If it is, we're *all* in trouble," Jerry said. "But they haven't found anything to indicate a disease. And even if it were—well, you know the old saying? Once is happenstance, twice is coincidence—"

"—three times, enemy action," Arthur concluded.

"Exactly."

Arthur looked at Daugherty's soft features. She seemed at peace, but—"Do you mind if we go back to the lounge? Talking in front of her is creeping me out."

"Sure." They took seats in the lounge, and then Arthur asked, "So what's the second reason why you called me in?"

"Well, it's like this. With the first two victims, we had nothing that connected them except their neighborhood. They both live in Morningside Heights. But Kiradi—well, he's a scientist working on virtual reality. We thought that might be significant."

Arthur raised his eyebrows. "That *is* significant. Where does he work?"

"Columbia. Pupin Hall."

"Physics," Arthur said with sudden understanding. "My specialty. I'm starting to get an idea of why you requested help."

"Good," Jerry said. "Dr. Kiradi works on a project called TTA, for Things That Aren't."

"You're kidding. They actually named it that?"

Jerry shrugged. "It's a university, they can name things whatever they want, I suppose. From what we've learned, it's devoted to improving virtual reality. Given these bizarre comas, it seemed likely that Kiradi's research was involved. And if that's the case—"

"—then it makes sense to have someone who can talk science with the other researchers. Got any names?"

Jerry opened his notebook again. "Kiradi worked with three other scientists: Trevor Bingham, Rod Carnegay, and Samuel Lansky."

Arthur shook his head. "Never heard of any of them. I thought the Ivies always had Nobel winners working for them. Which one's the head of the project?"

"Lansky."

"Have you spoken to him yet?"

"Nope. I was waiting for you."

Arthur stood up. "Well, first let me hit the Internet and do a little research before we head uptown. When we meet Dr. Lansky, I'm going to go talk to him, scientist to scientist. Maybe he'll open up and tell me something he wouldn't tell a cop."

Trevor Bingham walked aimlessly, unconsciously avoiding Columbia University, his eyes focusing just enough to prevent walking into streetlamps or people.

He had one hand tucked in his right-hand jacket pocket, his fingers running over the smooth, angled device.

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John Kiradi hadn't meant anyone harm, but his efforts were what mattered. And Rod Carnegay might be a fool, but he was a conscientious one. Still, it was amazing any of them accomplished anything under that self-important Lansky. John had been almost too easy to eliminate. Trevor was glad he had tested the inducer beforehand, just to make sure it would work properly. According to the readouts, John was trapped in a perfect fantasy moment for himself, a "reality" he would never want to question at the risk of losing it.

While he didn't wish either Kiradi or Carnegay ill, he wouldn't mind submitting Lansky to something unrelenting. It was just the matter of a few adjustments, he could do it. And then he would stop, his work accomplished.

Finally, he slowed and checked his watch. He'd find Carnegay away from the lab. Lansky could wait. Trevor knew he needed to pace himself.

It was a bright, sunny day, with only a few wispy white clouds hanging in the blue sky. Jerry drove the two of them uptown to Columbia in an unmarked cruiser and somehow managed to find a parking space on 120th Street, a short walk to Pupin Hall.

"So, what sort of special investigations do you normally do?" Jerry said, clearly making an effort to get to know the agent.

"High-tech applications of common items, figuring out how the next whacko will turn a stick of Silly Putty into C4," Arthur said casually. He liked Jerry, but the last thing he wanted to do was give him too much information on the real work of the Special Investigations division. The detective would either laugh in his face or demand to know more, and he wasn't cleared for it.

"Sounds a little dull," Jerry said.

Arthur nodded, willing to let Jerry believe that. "Nothing like this, which I like," Arthur said, gesturing around him. "The job is usually pretty dry despite the nice title. What's happening is on the streets."

Jerry shrugged. They walked past a pair of attractive young women, and Arthur swiveled his head to watch them walk by. "Nice coeds around here."

Jerry shook his head. "You know, you need to get out of the lab. No one calls them coeds anymore. Anyway, yeah, never a dull moment in New York," he said with a touch of sarcasm. "Robberies, muggings, people acting like the world owes them something. Nothing dry about street crime."

Arthur smiled. "I get it. Grass is always greener, that sort of thing. Then you must find this case diverting?"

Jerry bit his lip. "Diverting isn't the word I'd use. I'm terrified this thing goes wide—or worse, goes public."

"Makes sense. Hey, while I'm here, any chance you can score us Rangers tickets?"

"Doubt it. Hockey season ended last month."

"Damn." They lapsed into a not entirely comfortable silence.

Within minutes they were inside the building, then at the door to the laboratory. Arthur looked at Jerry. "You remember your cues?"

"Yep. Instead of good cop-bad cop, we're playing smart cop-dumb cop. All set."

Arthur knocked on the door, and a balding man in a white lab coat opened it a crack. He gave Arthur a wary glance, then looked at Jerry. "Are you the police who called?"

"Yes," Jerry said, flashing his badge. "I'm Detective Bancroft and this is Agent Valiquette. Are you Dr. Lansky?"

"Yes," the scientist said. He opened the door a little wider, and Arthur and Jerry entered the lab.

"Thanks for seeing us on such short notice," Jerry said.

"You're welcome. I was sorry to hear about John's coma. How's he doing?"

"Still the same," Jerry replied. "Wish I had better news."

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Arthur walked over to a large television monitor that sat on top of a metal box with flashing lights. He reached out for what looked like a helmet made out of four metal strips shaped into a hemisphere.

Lansky walked over to Arthur and placed his hands on the helmet. "Please be careful, Agent. That's valuable equipment."

Arthur let go, and Lansky put the helmet down. "Sorry," Arthur said.

Lansky nodded. "So why is it that the police and FBI are interested in our research?"

Arthur and Jerry exchanged a glance. "Well," Jerry said, "we're investigating what happened to Dr. Kiradi."

"And you think his research here had something to do with his condition?"

"Well, yes," Arthur said. "He's catatonic and yet showing normal brain function. It doesn't take a genius to wonder if his work in VR might be responsible."

Lansky frowned. "What exactly do you suspect us of?"

"Nothing, Doctor," Arthur said. "After all, accidents happen. But we do have to cover all bases."

Jerry nodded. "We're looking into the possibility that something Kiradi was working on might have led to their condition."

"Their?" Lansky asked.

"His," Jerry said quickly. "*His* condition."

Lansky shook his head. "I don't see how," he said. "What exactly do you know about virtual reality?"

"I don't know much, but Agent Valiquette here's an expert," Jerry said, pointing a thumb at Arthur.

Lansky turned to Arthur. "Really?" he asked with a hint of doubt.

"Sort of," Arthur replied with a glance to Jerry. "I've got two degrees in physics. Caltech and UC Irvine."

Both Lansky and Jerry looked surprised to learn this. Arthur shrugged. "So I can probably grok your project," he said.

"Well," Lansky said, "virtual reality isn't just physics. It's more like applied engineering."

"So tell us about it," Arthur said. "What exactly are you doing here?"

"I told you. Studying virtual reality. You know—body suits, data gloves, simulators, things like that."

"*I* don't know," Jerry said. "Could you explain?"

"What's to explain?" Lansky asked as if he was addressing a freshman. "We build a room with screens and speakers, and you go inside to experience being somewhere else. In essence, it's just a fancy simulator. But it's limited."

Arthur nodded. "Sight and sound only."

"Well, yes. Although for tactile sensation, you'd put on a glove or even a full body suit."

Jerry raised his eyebrows. "That could prove interesting."

Lansky seemed to miss any implications. "One day, perhaps, it will. But as far as I'm concerned, it's still clumsy. There's no way to create virtual smell or taste, for example."

"They do it on *Star Trek*," Jerry said.

Lansky's expression changed to one of distaste. "The so-called holodeck. Yes. Only they claimed to do it with electromagnetic force fields and other such gobbledygook."

"Gobbledygook?" Arthur asked with a smile. "That a technical term?"

The scientist ignored the crack. "The fact is that their scientific explanations for how the holodeck technology worked were spurious," Lansky said. "You can't create such an immersive experience, no matter how sophisticated the method you use."

"Not even with IMVR?"

The color drained from Lansky's face. "Where did you hear that term?"

"I found it on a website devoted to VR research," Arthur said. "It's apparently a term you came up with."

"Oh." He gave Arthur a half smile. "Well, IMVR is rather primitive. Most of

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my comments have been purely speculative."

"Pardon me," Jerry said, hitting his cue, "but I've never heard of this. What's IMVR?"

Lansky glanced at Arthur and then turned to Jerry. "The acronym stands for 'interior method virtual reality.' If we could ever get it to work, it would be a way of bypassing the sensory organs and sending the virtual sensations directly into the brain."

"I still don't understand," Jerry said.

Lansky bit his lip; it was clear to Arthur that the last thing he wanted to do was explain IMVR to a layperson. But he said, "I'll try to make this simple. Do you remember learning how your eye works when you took high school biology?"

"Well, it's been a while. This isn't the usual sort of thing I think about."

Arthur stepped forward and smiled. "Allow me to try, Dr. Lansky. You can let me know if I'm getting it right." He turned to Jerry. "I think I can explain what Dr. Lansky's getting at. Normally, the way you see something is that light from outside enters your eye and is picked up by cells in the back of your eye, called rods and cones. Then these cells send a signal along your optic nerve into your brain, which your brain interprets as an image. With me on that?"

Jerry nodded. "Sure."

"Okay. Now you know that for you to see something, the optic nerve has to be stimulated. So what would happen if we could send an electric pulse directly into your nerve that makes it react exactly the same way?"

Jerry snapped his fingers. "I'd 'see' something that isn't really there."

"Exactly," Lansky said. "That's the goal of IMVR. Instead of having to create simulations outside your sensory organs, we could create simulations by sending the images and other sense impressions directly into your brain."

Jerry looked around nervously. "So where's this IMVR device?"

"Oh, we don't have one," Lansky replied quickly, with a chuckle. "That would be the holy grail of our research. No one's managed to build one yet."

"So you don't have anything like that here?"

Lansky looked worried. "Well—"

Arthur looked at Jerry. "I think we should tell him the full story."

"What full story?" Lansky asked.

Jerry took a deep breath. "Dr. Lansky, Kiradi's not the only person we found in this condition."

Lansky looked surprised, but quickly recovered. "I knew there had to be something more you weren't telling me."

"In the past two weeks, two other people were found in this condition in the area. Before John Kiradi. All three are catatonic and unresponsive, but with normal EEGs. It's as if their minds are just, well, somewhere else."

Lansky put his fingers together. "I think I start to see why you wanted to meet with me."

"I certainly hope you do," Jerry said. "So now that we've leveled with you, maybe you can level with us."

"I will, but I don't see how our research is relevant."

Arthur shook his head and sighed. As he asked his question, he ticked off points on his fingers. "Look, doctor, are you saying that you're doing research that involves sending signals directly into the brain, and that three people, including one of your researchers, have their minds trapped in some sort of loop, and you don't think there's a connection?"

"No, I don't."

"So, what? You think it's something in the air?"

Jerry shot Arthur a look and then turned back to Lansky. "How can you be so sure there isn't a connection, doctor?"

Lansky smiled placidly. "Because we don't experiment on human beings

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here, Detective. All our work has been done on animals. Mostly rodents and cats."

"Chimpanzees?" Arthur asked. "Apes?"

Lansky waved his hands in frustration. "Well, that would be the next step, obviously. But for the moment, no."

"Well," Jerry asked, "how come you're so sure that none of your colleagues has already started experimenting on humans?"

Lansky sighed. "Because all of our work is surgical. The only way to bypass the sensory organs is to operate on an animal's brain so we can feed electronic pulses directly into the neurons." He paused. "I don't suppose the examinations showed that the victim's brains had electrodes attached to them, did they?"

Arthur glanced at Jerry, who shook his head. "No. No Pinheads. Besides, any electrodes implanted in them would have come up in the MRI."

Lansky's eyes widened. "You did an MRI on the victims? That would have ripped any electrodes right out of their skulls."

"Who knew? Are you sure that electrodes are necessary?" Arthur asked.

Lansky looked thoughtful for a moment. "Absolutely. There's simply no way to induce IMVR in someone without invasive surgery." He paused. "Look, if you'd like, I can show you around the whole lab, even explain the surgical procedure and how it works. It'll take about an hour."

"No, thanks," Arthur said suddenly. "I think we've heard all that we need. Sorry to have bothered you."

Lansky nodded. "Well, if there's anything else I can do, let me know."

As they walked back to their car, Jerry said, "Why did you cut and run? We almost had him admitting that this INVR stuff was real."

"IMVR. And that's why I cut things short. Lansky was too ready to admit to doing IMVR research, which meant that he wasn't going to give us enough for a warrant. And the last thing I wanted to see was a bunch of post-op animals."

"So what do we do now? Any suggestions?"

"Yep. You try to get in touch with Lansky's colleagues. I'll give Lansky a call tomorrow afternoon and see if he'll say something in front of me that he didn't want to say in front of you."

"And if he won't?"

"Then we bring him in."

That night, Trevor waited in front of Rod Carnegay's apartment building for him to come home.

Trevor watched as other people walked by. He withdrew the inducer from his right pocket, a gloved hand brushing across it. His thumb twitched as he fought to control himself.

He had determined Rod would get a pleasant world to live out his days. For a moment he tried to imagine what it would be. A life of research? Or indulging in that silly passion for baseball he had? He chuckled to himself at the ridiculous idea of the pudgy, older man running around in a pinstriped double-knit polyester uniform alongside twenty-year-olds.

His mind drifted to the hopes and desires of the people walking up and down the block. The power to grant those wishes sat quiet in his hand.

He shuddered. Temptation to use the weapon was all the more reason why he had to take this step.

Finally, he spotted his prey. Despite the warm weather, Rod was dressed in an overcoat and a knit cap. Trevor backed up against the brick wall of the apartment building, aimed the inducer at Carnegay's head, and fired. The small digital readout lit up, indicating that it was working perfectly. Trevor waited, expecting to see Carnegay freeze up and then fall to the ground.

But it didn't happen. Carnegay kept walking.

Confused, Trevor fired the inducer a

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second and then a third time, and still Carnegay refused to collapse.

And then Carnegay spotted him. Carnegay froze for a moment and then darted away in the direction from which he had come.

Trevor ran after him and caught up with him in an alleyway between two buildings. Having nowhere to run, Carnegay turned to face Trevor.

"Hello, Rod," Trevor said.

"Hello, Trevor," Carnegay said, keeping the distance between them. "I knew you were up to no good when I heard about John."

"What gave me away?"

"You haven't exactly been keeping your worries to yourself." He paused. "When I heard about John's coma, I knew you had to be responsible. You figured out how to build the inducer, didn't you? Brilliant work, I have to say. And yet, you're using it as a weapon."

"I had to do something," Trevor said, taking a step closer. "The rest of you wouldn't listen to me."

"Trevor, you're being ridiculous," Carnegay said, retreating to maintain distance.

"No, I'm not. IMVR is too dangerous to unleash upon the world."

"And yet here you are, using the inducer to stop people from using the inducer. Don't you see how irrational you're being?" He took another step back but almost tripped as he backed into the unyielding brick wall behind him.

Trevor sadly shook his head. "I don't really see how I have a choice."

"Of course you have a choice!" Carnegay shouted. "Give us the inducer and show us how it works so we can publish."

A chill ran through Trevor's body, and his stomach felt queasy. "No," he said. "That's exactly why I built this. So that none of you could publish."

"You know how crazy that sounds?"

Trevor just stared at him.

Carnegay tried to step back once more, but he had gone as far as the building allowed. "So what are you going to do?"

"I'm going to zap you now, and as soon as I can find him, I'll zap Lansky as well. The two of you can join John in a perfect world. It'll be peaceful for you. Well, at least for you and John."

"And then what? Are you going to file your own patent and sell the technology as your own?"

"No!" Trevor shouted. "Don't you understand? I'm going to bury the research forever. I didn't build this to get rich. I wanted to prove it can be done, but then John started talking about those unthinkable applications. That's not why we researched and studied these last five years."

Carnegay sighed, his shoulders slumping. "You can't put the genie back in the bottle, Trevor. Once the technology has been developed, it's only a matter of time before someone uses it. Or someone else also discovers it."

Trevor aimed the inducer again, but Rod shook his head. "It's no use, Trevor. I figured out how to block the inducer. You might as well just give up." He took a decisive step forward and put out an open hand. "Give me the inducer, and let's go bring John back into the real world."

"No," Trevor said. His hand tightened around the inducer.

"Fine. I'm going to tell Samuel what's going on."

Trevor stepped forward. "Tell me how you managed to block the inducer."

"What, so you can use it on me? Absolutely not."

"But—I must. You don't understand, do you?"

Carnegay reached into his coat and pulled out a steak knife. "Let me pass, Trevor."

Trevor stared at the knife. "You have got to be kidding," he said. He imagined the sight they made—the young man holding a Buck Rogers device in his

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hand, facing off against an old man defending himself with a thin, serrated knife.

"When I heard about John's coma, I knew I had to protect myself. Now get out of my way."

"Or you'll stab me?"

"If I have to," Carnegay said calmly.

The two of them stared at each other for a moment, and then Trevor backed off to the side.

"Good," Carnegay said. "Now hand me the inducer."

"No."

"Fine," Carnegay said. "I'll just—"

Carnegay jumped him.

The inducer went flying out of his hand, clattering into the darkness, but Trevor didn't have time to go after it. He grabbed Carnegay's hands, fighting to wrest the knife from his grasp. Carnegay held on tightly, and the knife twisted back and forth.

But the older man was no match for Trevor's strength. Trevor managed to pry the knife loose and grab it with his own hand. He tried to free himself, but Carnegay pushed forward, and Trevor turned the knife on him. With a quick stab, he punched the knife high into Carnegay's stomach, marveling at how easily it pierced through the overcoat, clothing, and then skin. A red bloodstain rapidly appeared on Carnegay's coat, and his eyes opened wide. Carnegay coughed twice and fell over, a shocked expression on his face.

Trevor caught his breath, dug the knife around inside Carnegay for a moment, and then pulled it out, hearing skin and cloth tear. The sound sickened him. Both the knife and his hand were stained with Carnegay's blood. Trevor wiped the knife clean on Carnegay's coat and looked at Carnegay's lifeless body.

His mind snapped. *Oh my God,* he thought. *I've killed him he's dead he's dead I'm a murderer—*

He took a few deep breaths and calmed down. *It's his own damn fault. In fact, all of them have no one to blame but themselves. I warned them.*

Trevor had to get away before anyone else came into the alley. He grabbed Carnegay's hat, pulled it down over his own head to hide his features, and ran from the alley.

The renegade scientist had locked himself safely in his own apartment before he finally figured out Carnegay's defense. The notion made him giggle. It wasn't until Trevor sank into a worn easy chair that he remembered the missing inducer.

At least he had a spare.

News of Dr. Carnegay's murder reached Jerry and Arthur quickly the next morning, and Jerry cursed his inability to reach either of them the day before. They headed back uptown, this time to the crime scene, where the alleyway had been cordoned off with police tape. Jerry flashed his badge at one of the uniformed officers, who let them pass.

Not that there was much to see by this time. A chalk outline showed where Dr. Carnegay's body had lain. Dried blood was all that remained. Jerry asked the first responders a few questions about how and when the body was found, while Arthur stood there examining the scene for any other clues that the others might have missed.

After about twenty minutes, Jerry finished up with the first responders and walked back over to Arthur. "Looks like we're not going to get much information here. I suggest—"

Suddenly, one of the uniformed officers approached Jerry. "Detective, I think you should see this. CSU has found something interesting."

One of the crime scene officers held a plastic bag. Inside there was a small electronic device with an angled head.

"It looks like one of those handheld vacuum cleaners," Jerry said.

"With a few added modifications." Arthur stated. "Amazing how small this

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is. Like a kid's toy, not something potentially deadly."

"Do you think it sucks out people's brains?"

"Maybe it puts something in them," Arthur said.

"So, Lansky's holy grail exists?"

"I think we ought to ask Dr. Lansky about it once CSU's examined it for prints. At this point, it's fairly certain that either he or Bingham is the unsub we want."

Jerry frowned. "If we know who the subject is, then he's no longer unidentified."

Arthur shrugged. "I go by the book."

Jerry nodded. "Fine. Let's go pick him up and see what he thinks of this device. I'll also send two officers to detain Dr. Bingham."

A few hours later, after the device had been dusted, photographed, measured, and annotated, Jerry and Arthur headed back to the Things That Aren't laboratory along with four uniformed officers. Within seconds, Dr. Lansky opened up and Jerry pushed himself in, followed by everyone else.

"Good morning, Dr. Lansky," Jerry said. "We want to talk to you."

Lansky seemed surprised by the policemen's aggressive approach. He stepped back, giving his newfound guests plenty of room. "About what?"

"About Rod Carnegay's murder."

Lansky turned pale. "What?" he croaked.

"Carnegay was killed last night. Do you know anything about it?"

"I—I—"

Arthur stepped forward. "Well, then," he said, "do you know anything about this?" He held the plastic bag with the device up to Lansky's eyes, and the blood drained from his face.

"Trevor," he said. "You actually did it."

"Trevor?" Jerry asked. "Do you mean Dr. Bingham?"

Lansky turned to Jerry, his expression going from shock to anger. "Yes. Dr. Bingham. He threatened to build it, Detective, but I didn't believe him. He said he was going to show the rest of us how dangerous our research was."

"Build what?" Arthur asked. "What is this?"

"It's a remote inducer."

"A what?" Jerry asked.

"I think I know," Arthur said, nodding. "It's your holy grail, isn't it? An IMVR device." Arthur looked around quickly. "I bet you've got a nonportable version around here somewhere."

Lansky nodded and pointed to a metal cube in the corner of the lab, roughly ten feet on each side. "It's the main focus of our research."

Jerry glared at him. "So why didn't you tell us that before?"

"Corporate espionage." It was said so matter-of-factly that it caught Jerry by surprise.

"You lied to us to protect your trade secrets? Like we'd even think to profit from your work?" Jerry shook his head. "Because of you, Dr. Carnegay is dead, and Dr. Kiradi and two other victims are in comas."

"It's not my fault," Lansky said defensively. "Besides, the comas are probably reversible. It's what I've been working on ever since yesterday."

"Reversible?" Arthur asked. "How so?"

"I'd have to explain how the inducer works."

"So go ahead," Jerry said. "None of us are going anywhere for a while."

Lansky nodded. "The inducer fires pulses of ultrasound into a person's brain after priming the brain with transcranial magnetic stimulation."

"Trans-what?" Jerry asked.

Lansky sighed. "Let me start from basics."

"Please."

"Suppose you wanted to affect someone's mind. Give them hallucinations, let's say. Do you recall what I told you before? How would you go about doing that?"

"You'd have to stimulate the brain di-

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rectly," Jerry said.

Lansky nodded. "Exactly. That's what we've been working on in the TTA project. People have done direct stimulation of the brain before, by attaching electrodes surgically and then sending impulses into the neurons. But our new device works differently. It's wireless." He shook his head. "And for the longest time, I never thought we would get it to work."

"Why not?" Jerry asked.

Lansky turned to Arthur. "Agent Valiquette, you have a physics background. How would you go about doing this?"

Arthur thought about it. "I suppose I'd have to use some sort of magnetic field to induce a current flow in the neurons."

Lansky raised his eyebrows. "You've been reading up."

"It's simply applied electromagnetism. Any college kid could figure it out."

Lansky nodded. "Okay. What you may not realize is that in the VR field, we have a name for this technique: transcranial magnetic stimulation, or TMS."

"You mean it's already been developed?" Arthur asked.

"No, it's simply been researched, and up until now, found to be lacking."

"Why?"

"It's too crude. TMS works by using rapidly changing magnetic fields to induce currents in brain tissue. The problem is that the fields can't be finely focused on small groups of brain cells. So instead, people looked into using ultrasound pulses, which could be aimed more precisely."

"I take it that didn't work, either."

Lansky nodded. "Their problem was that ultrasound pulses only gave crude hallucinations."

"It's like Goldilocks and the three bears," Jerry said.

Both Arthur and Lansky turned to him. "What?" Lansky said.

"You know, the old children's story? The first bowl of porridge was too hot, but the second was too cold. The TMS thing you described is too big, and the ultrasound is too small. So what'd you do, go with a combination?"

Lansky's jaw dropped. "How did you—that's exactly what we did. We built a VR inducer that starts with TMS and then fires ultrasound pulses."

"So," Arthur said, "in essence, the TMS makes the brain cells more pliable to receive the hallucinations, and then the ultrasound pulses deliver the hallucinations?"

"Exactly. That's exactly it."

Jerry whistled. "So we go from the *Star Trek* holodeck to *The Matrix*."

"I suppose you could say that," Lansky said, "but I'd rather you didn't."

Jerry shrugged. "You don't have much choice about that, I'm afraid. People are going to describe this thing in terms that they know."

"There's two things that are still bothering me, Dr. Lansky," Arthur said. "First of all, what's Dr. Bingham doing?"

Lansky sighed. "Trevor's had an epiphany. At first, he was excited to be working on IMVR, but then he became convinced that the technology would be used as a weapon. A common enough fear in our work. I dismissed his fears by pointing out that it was impossible to build a small enough inducer to carry around like a gun." He paused. "I guess I was wrong. Now it looks like he's trying to stop the project from moving forward."

"By putting the rest of you in comas?" Jerry asked.

"Trevor fancies himself a humanitarian. He probably programmed the inducer to create a peaceful world for John to live in. But if he killed Rod . . ."

"From what we can gather," Jerry said, "that might not have been his first choice. After all, we found the inducer lying on the ground. Looks like there might have been a struggle, forcing Bingham's hand."

Lansky shook his head. "I can't see that."

"Moving on," Arthur said, "we've got

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motive now, fine. But I've got a second question, and this one is technical. Shouldn't the hallucinations stop when the device is turned off? Why are the three victims still in comas?"

"That's what I've been trying to figure out ever since yesterday," Lansky said. "The hallucinations should stop once the inducer is turned off or is no longer pointing at them. Trevor must have figured out a way to create a feedback loop in the victims' brains."

"Can you help them?"

"Possibly. The feedback loop is not something we ever considered. I might be able to figure out how Trevor rigged the inducer. If I can, I might be able to break them out."

"Whether or not you can free them," Jerry said, "we know he's still committed one real murder, the old-fashioned way. Which means we still need to find and apprehend him."

"He wasn't at home?" Lansky asked.

"Would you be?"

"No, I suppose not."

Jerry sighed. "Dr. Lansky, we could really use more of your help. Is there anywhere else Dr. Bingham might go? Does he have a girlfriend or family?"

"I—" Lansky looked thoughtful. "You know, I really don't know. He's never been much to talk about his personal life."

"Great. Any other labs where he might be working?"

"I suppose you could check his personnel file."

"We already have," Jerry said, obviously nettled. "That's how we found his apartment. But he wasn't there, and he hasn't been spotted by stakeout." He sighed. "At least he doesn't have the inducer."

"Uh—" Lansky shook his head. "I wouldn't be so sure of that, Detective. Trevor's methodical. I can't imagine he would have left this one behind if he didn't have another one."

Jerry said, "If so, then we've got a problem. If we approach him, he could give us hallucinations."

"Exactly."

"So how do we block this thing?"

"Well, you'd need to protect the brain. Encase it in something akin to a Faraday cage."

"What's a Faraday cage?" Jerry asked.

"It's a hollow conductor that blocks electromagnetic radiation. Electric fields that hit the conductor cause the electrons on it to move around so that the field is nullified inside."

Arthur stared at him. "You're saying that the best way to protect our minds would be to cover our brains in metal."

"Well, not directly," Lansky said. "It's not like you'd have to have surgery. You just need to wrap the top of your head with a malleable metal."

Arthur blinked as an image came to his mind. He began to chuckle, but the chuckle soon grew into a loud guffaw.

"What is it?" Jerry asked. "What's so funny?"

Arthur wiped the tears from his eyes. "The best way to protect oneself," he answered, "is to wear a tinfoil hat."

There was silence for a moment, and then Jerry started to laugh as well.

Finally the laughter trickled away. "That might explain why he knifed Dr. Carnegay, though," Jerry said.

"What do you mean?" Arthur asked.

"According to the responding officers, Dr. Carnegay's hair was mussed, and scraps of foil were found near his body. If Carnegay had worn a tinfoil hat, Bingham would have had to resort to more primitive means, such as killing him."

"And then he would have taken the hat away so we couldn't figure it out," Arthur said. "Carnegay must have suspected that Bingham was up to no good."

"So what do we do?" Jerry asked. "Issue tinfoil hats to the apprehending officers?"

"That would be step one," Arthur said with a nod. "As for step two—" He placed the bag with the inducer in it on

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a lab bench. "Dr. Lansky, do you have any idea how to program this thing?"

"It's not that hard, actually. You can set it to stimulate a pattern of neurons in the brain that will create whatever VR simulation you want. Why?"

"Because if you're willing to serve as bait, I think I know how to capture Dr. Bingham."

Trevor was surprised when the police turned their search for him into a public manhunt. His face and name were plastered all over the media, with a phone number for people to call if they spotted him.

However, he wasn't too worried. If anyone appeared to recognize him, a quick zap with his spare inducer would take care of that. After all, that was how he had convinced the cops who had knocked on his door that his apartment was empty.

There was still one loose end he had to handle—Dr. Samuel Lansky. If they ever found his lost inducer, Lansky was the only person who could figure out how it worked. And if that happened, Lansky might patent it and reveal all its secrets to the world, and all of Trevor's work would have been for nothing.

A new report came on NY1 cable news about his case. Apparently, the police were planning to transfer Dr. Lansky to a secure location, but only after giving him a chance to pack up the lab at Pupin. To keep Lansky safe, the cops would be guarding the building while he was inside.

Trevor smiled. They had no way of knowing how easy they had just made his final "kill."

Arthur crumpled the wrapper and tossed it, banking it off the wall into the large wastebasket in the empty lab.

"New York's supposed to be known for its delis. That wasn't worthy of world-renowned."

"You have to go downtown."

"What, like Times Square?"

"Lower. Katz's is what you want for authentic. Or the new Second Avenue, on Third."

"So, you want to show me either place when we're done?"

Jerry cocked his head and stared at Arthur for a few seconds. Arthur looked down at his lapel and tie. "What, do I have mustard on me?"

"No, it's just—That's one very scary weapon out there and we're letting two scientists hash it out. Doesn't that bother you?"

Arthur wiped his hands on a napkin and banked that off the wall, falling short this time. "I'm a scientist by training. They've developed some scary shit, but it's also very compelling work. You don't quite grasp the significance of Bingham's development."

"Maybe. To me, it's just another way to screw with people's lives. I can recognize it from a distance, but seeing those three in the hospital . . . well, better it remain a theory."

"Too late for that, Jerry."

"No shit."

Dressed in an overcoat and cap, Trevor walked towards Pupin Hall. Sure enough, four uniformed police officers stood in front of the building, scanning the pathways in front, papers with his picture in their hands. Quickly, he stayed behind a tree, his back to them before he was recognized.

He felt a moment of giddy dizziness, but it passed. One of the advantages he had over the four officers was that he worked at Columbia for years and knew ways into the building that outsiders wouldn't consider. He felt cloaked in confidence.

Trevor entered the building and climbed the stairs to the TTA lab. He shoved the door open, and it banged against the wall.

Dr. Lansky was standing behind a lab bench in the middle of the room, flanked by two men in suits, one older, one younger. Before they could pull

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their own weapons, Trevor fired the inducer, and they each collapsed, leaving Dr. Lansky the only one standing.

"Trevor," Lansky said, his hands trembling.

"Samuel."

"What happens now?"

"I leave you in your own fantasy world for the rest of your life. Sorry it won't be a pleasant one."

Lansky nodded. "Just one question. Why?"

"You know why. This technology's too dangerous to develop."

"That isn't your decision to make. We did all the research together."

"Maybe, but I found a way to make it work. The rest of you twiddled your thumbs and said it couldn't be done," Trevor replied.

"So you proved yourself better. Was that worth killing Rod?" Lansky asked. His hands dove into the lab bench drawer and pulled out Trevor's lost inducer. Fortunately, Trevor already had his own inducer aimed. He fired it immediately. Dr. Lansky froze and fell to the ground, trapped in his own twisted world.

Trevor walked over to him, picked up the lost inducer, and shoved it in a pocket.

"Believe it or not, I'm really sorry, Samuel," he said. "I'm not an evil person. You and John are both living in worlds you deserve." He paused. "It's too bad about Rod, but he forced my hand."

Lansky, of course, lay on the ground, unmoving, unseeing. Trevor thought he saw the hint of a smile on Lansky's face, but it was probably just his imagination.

He left the building and walked home, enjoying the gorgeous weather. It was over. Everyone else who had been a part of Things That Aren't was now dead or as good as dead. Trevor had made the world safe again. He decided that he would wait a year, and only then reveal to the media exactly what he had done. The public would laud him for his noble actions.

He was living in a perfect world.

Arthur and Jerry looked at Bingham as he lay at their feet on the ground in front of Pupin Hall, his eyes staring blankly into space.

"Well?" Arthur asked Lansky, who stood there with the inducer pointed directly at Bingham's head.

"It's working," Lansky said. "Dr. Bingham's in his own little fantasy world."

Arthur looked over at the building, where the four uniformed police officers still stood, watching for any other potential threats. "I'm glad you zapped him before he could reach for his own weapon."

"I didn't want to take any chances. But what now? We can't just leave him here."

"No, we can't. Keep the inducer on." Arthur put his hands on his head, checking to make sure that his tinfoil hat was secure. Then he walked over to Bingham, crouched next to him, and gently removed the second inducer from his grip.

"Your turn," he said to Jerry.

Jerry bent over Bingham, lifted the man up into a sitting position, and cuffed him.

"Okay, he's secure," Jerry said. "Whenever you want to turn off the inducer, go ahead."

"You sure you licked the feedback loop problem?" Arthur asked Lansky.

"Once I opened up the inducer, it took me an hour to reverse-engineer Trevor's work. The benefits of having worked alongside him for years."

Lansky walked over, the inducer still pointed directly at Bingham. "Ready?"

"Ready," Arthur said. "In some ways I feel sorry for the guy."

"Sorry? How can you feel sorry for him?"

"Easily. We just beamed a perfect scenario into his mind. As soon as he returns to reality, it will be the worst letdown of his life."

Lansky grunted. "Better him than us."

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Arthur watched as Lansky got ready to turn off the inducer. He thought about the proverbial can of worms that once opened couldn't be reclosed. Now that the technology for creating perfect hallucinations existed, it was only a matter of time before others developed it as well and changed the world. Just as radio, television, and wi-fi signals were constantly broadcast as invisible waves around them, so too could TMS and ultrasound. Arthur imagined the new world as one in which people would have to protect themselves with tinfoil hats or risk falling into hallucinations.

"He's in for a rude awakening," Jerry said.

Arthur nodded. "As are we all."

Lansky turned off the inducer, and within seconds, Bingham's eyelids fluttered. He darted his head around, taking in his true reality, and he screamed. ■

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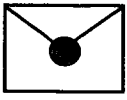

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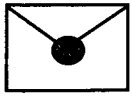

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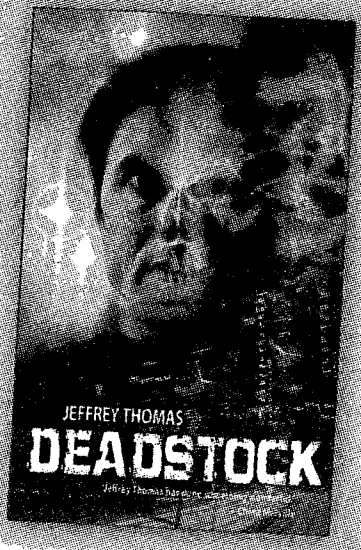

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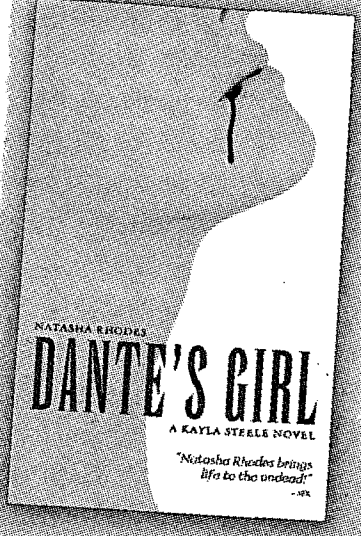

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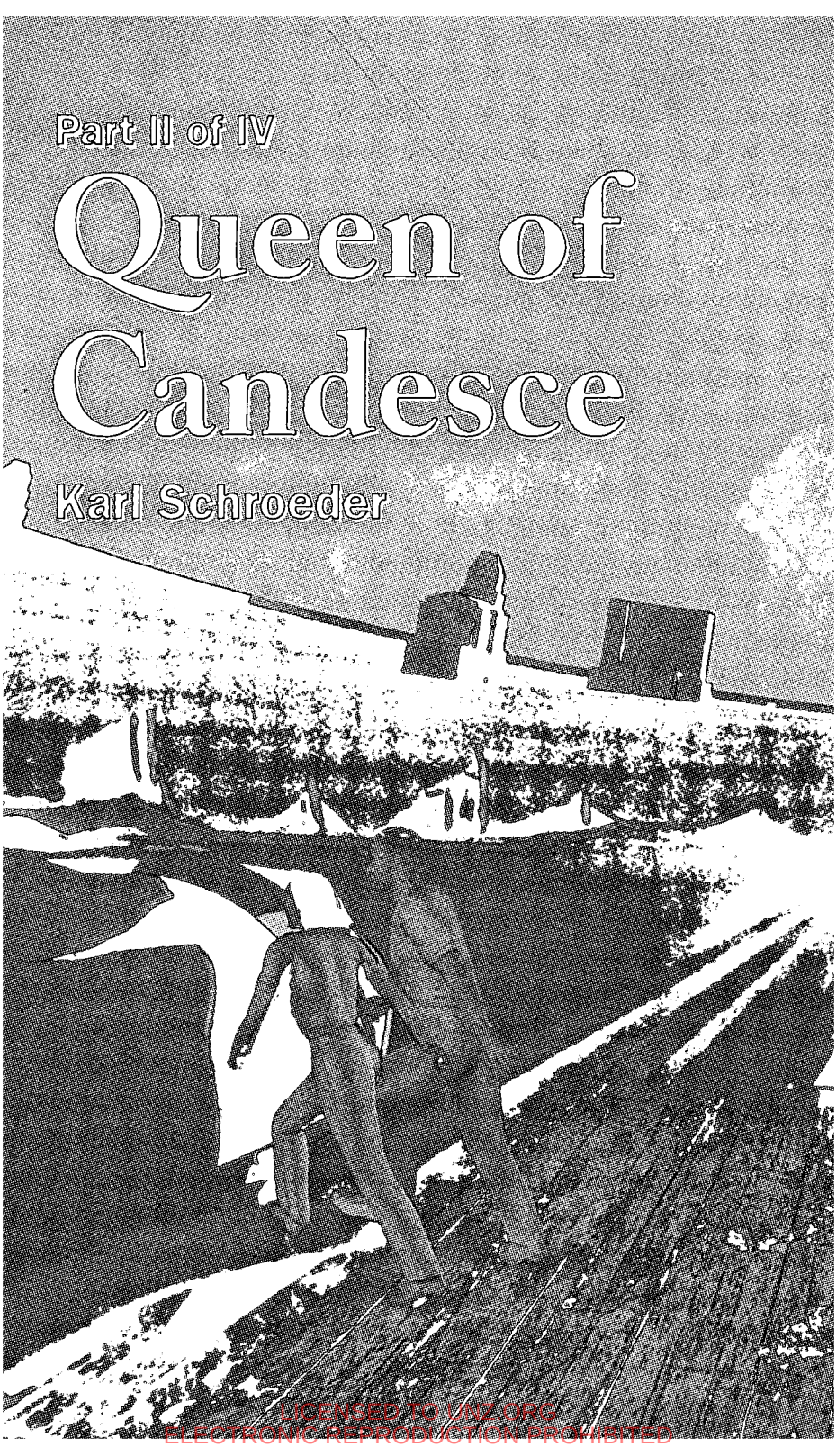

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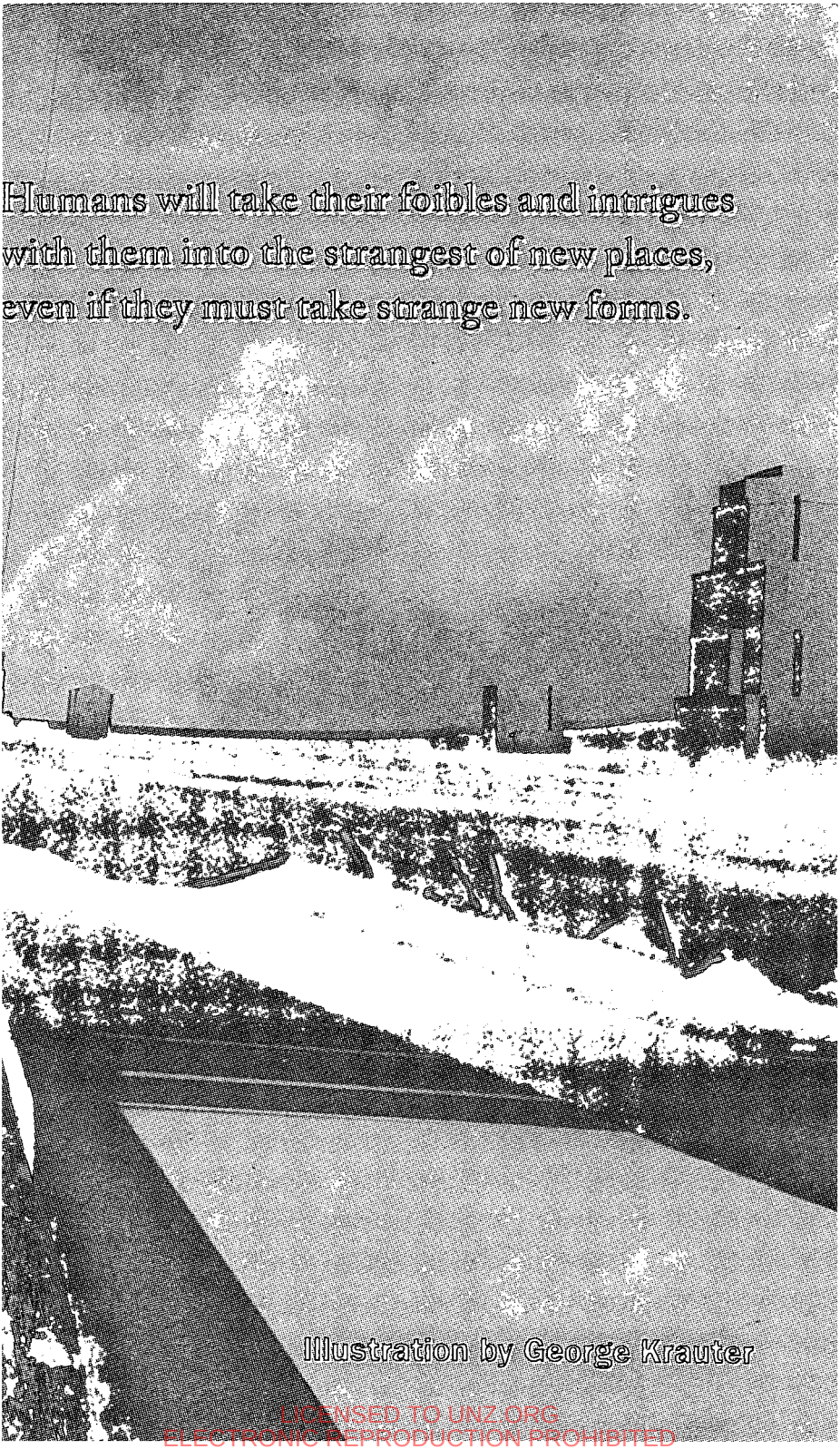
Humans will take their foibles and intrigues with them into the strangest of new places, even if they must take strange new forms.



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The Story So Far

A woman is falling from the sky. She's taking a long time doing it, so ***Garth Diamandis****, aging playboy and exile on Greater Spyre, takes his time in setting up her rescue.*

Greater Spyre is circular, a vast open-ended cylinder of metal at least twelve miles in diameter. Spyre is thousands of years old and is slowly falling apart. Its inner surface is paved with dirt and trees and dotted with strange, inward-turned pocket nations. Garth's people have always lived here, either in the paranoid miniature kingdoms of the cylinder, or in the rotating cities that hover in the open air around which Spyre revolves. Few of them have ever taken an interest in the world beyond Spyre; yet this woman has drifted in on the weightless air from that very world.

Garth manages to catch her before she tumbles to death on Spyre's inner surface and takes her home to the damp basement he's called home for the past dozen years or so. It is here that ***Venera Fanning*** *awakens a day later.*

Ah, Venera: sociopath princess, pampered courtier, and spy-mistress; casual murderer, recent savior of the world, and wife of ***Admiral Chaison Fanning*** *of Slipstream. Garth, ladies-man that he is, is immediately besotted with her. But he can't puzzle out her strange story, which involves pirates, betrayal, and ruin at the very heart of the world.*

Some of what she says is familiar. Garth knows that Spyre is one tiny object spinning in the immense artificial world known as Virga. Virga is a hollow sphere—a balloon, essentially—several thousand miles in diameter, orbiting on its own somewhere in deep space. The balloon contains air, water, drifting rocks—all the necessities of life, including man-made fusion suns that light small parts of its vast volume. Nations coalesce around these suns, and the greatest sun is Candesce, which lies at the very center of Virga. There is no gravity in Virga, save that which you can make using centrifugal force. Spyre is one of the most ancient of the habitats built to take advantage of Virga's strange environment.

It is also a place where, once you have arrived, you may never leave. Garth tries to convince Venera of this fact, but she refuses to believe him. She comes from Slipstream, a nation of mile-wide wood-and-rope town-wheels and free-floating buildings and farms a thousand miles from Spyre. Born to privilege, used to freedom—and ever sure of herself—she sneaks away from Garth to attempt a grand leap off the edge of Spyre. Before she can reach weightless air and escape, however, she is captured by soldiers of the four-acre nation of Liris. Dragged inside the single cube-shaped stone building that makes up the ancient nation, she is forcibly made into a citizen and called on to serve ***Margit****, Liris's "botanist" or ruler.*

Serving the botanist is educational. Venera learns that the claustrophobic principalities that dot the cylinder's surface are ancient. Some are so old that they still possess treasures taken from Earth when Virga was first made. Liris, for instance, is the only place in the world where cherry trees grow. Liris and its neighbors sell their rarities in the Great Fair of Spyre, and the botanist intends for Venera to work there until the end of her days.

Margit is going to guarantee Venera's loyalty by injecting her with a drug that will cause madness unless regular doses of an antidote are provided. Venera knows that time is running out, but there are things she must know. She visits the Fair to ask about goings-on in the outside world.

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Almost immediately she learns that her husband, Admiral Chaison Fanning, has been reported killed in a great battle on the far side of the world.

Overcome with ice-cold grief and outrage, Venera confronts Margit in her bedchamber. The two women fight but Venera gets the upper hand, injecting the botanist with her own diabolical drug and sending her screaming into the night. Then, assembling the stunned citizens of Liris, she declares Margit's most tragic victim to be the nation's new botanist. Then she walks away from Liris, with no plan and no home anymore to escape to. Alone, aimless and hopeless, she returns to the one man in Spyre she can trust: Garth Diamandis.

7

Venera didn't really notice the passage of the next few days. She stayed with Diamandis in a clapboard hut near the edge of the world and did little but eat and sleep. He came and went, discreet as always; his forays were usually nocturnal and he slept when she was awake.

Periodically she stepped to the doorway of the flimsy hideout and listened to the wind. It tore and gabbled, moaned and hissed incessantly, and in it she learned to hear voices. They were of people she'd known—her father, her sisters, sometimes random members of the crew of the *Rook*, whom she had not really gotten to know but had heard all about her during her adventures with that ship.

She strained to hear her husband's voice in the rush, but his was the only voice she could not summon.

One dawn she was fixing breakfast (with little success, having never learned to cook) when Garth poked his head around the doorjamb and said, "You've disturbed a whole nest of hornets, did you know that?" He strolled in, looking pleased with himself. "More like a nest of whales—or capital bugs, even. There's covert patrols crawling all over the place."

She glared at him. "What makes you think they're after me?"

"You're the only piece out of place on this particular board," said Diamandis. He let gravity settle him into one of the hut's two chairs. "A queen in motion, judging by the furor. I'm just a pawn, so they don't see me—and as long as they don't, they can't catch you either."

"Try this." She slammed a plate down in front of him. He eyed it dubiously.

"Mind telling me what you did?"

"Did?" She gnawed her lip, ignoring the stabbing pain in her jaw. "Not very much. I may have assassinated someone."

"*May* have?" He chortled. "You're not sure?" She simply shrugged. Diamandis's expression softened. "Why am I not surprised," he said under his breath.

They ate in silence. If this day were to follow the pattern of the last few, Diamandis would now have fallen onto the cot Venera had just vacated, and would immediately commence to snore in competition with the wind. Instead, he looked at her seriously and said, "It's time for you to make a decision."

"Oh?" She folded her hands in her lap listlessly. "About what?"

He scowled. "Venera, I utterly adore you. Were I twenty years younger you wouldn't be safe around me. As it is, you're eating me out of house and home and having an extra mouth to feed is, well, tiring."

"Ah." Venera brightened just a little. "The conversation my father and I never had."

Hiding his grin, Diamandis ticked points off on his fingers. "One: you can give yourself up to the men in armor who are looking for you. Two: you can make yourself useful by going with me

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on my nightly sorties. Three: you can leave Spyre. Or, four—"

"I thought you said I could never leave," she said, frowning.

"I lied." Seeing her expression, he rubbed at his chin and looked away. "Well, I had a beautiful young woman in my bed, even if I wasn't in there with her, so why would I let her go so easily? Yes, there is a way out of Spyre—potentially. But it would be dangerous."

"I don't care. Show me." She stood up.

"Sit down, sit down. It's daytime, and I'm tired. I need to sleep first. It's a long trek to the bomb bays. And anyway . . . don't you want to hear about the fourth option?"

"There is no other option."

He sighed in obvious disappointment. "All right. Let me sleep, then. We'll visit the site tonight and you can decide whether it's truly what you want to do."

They picked their way through a field of weeds. Lesser Spyre twirled far above. The dark houses of the great families surrounded them, curving upward in two directions to form a blotted sky. Venera had examined those estates as they walked; she'd hardly had the leisure time to do so on her disastrous run to the edge of the world. Now, as the rust-eaten iron gates and crumbling battlements eased by, she had time to realize just how strange a place Spyre was.

On the steep roof of a building half-hidden by century oaks, she had seen a golden boy singing. At first she had taken him for some automaton, but then he slipped and caught himself. The boy was centered in bright spotlights and he held a golden olive branch over his head. Whether there was an audience for his performance in the gardens or balconies below; whether he did this every night or if it were some rare ceremony she had chanced to see—these things she would never know. She had touched Garth's shoulder and pointed. He merely shrugged.

Other estates were resolutely dark, their buildings choked in vines and their grounds overgrown with brambles. She had walked up to the gate of one such to peer between the leaves. Garth had pulled her back. "They'll shoot you," he'd said.

In some places the very architecture had turned inward, becoming incomprehensible, even impossible for humans to inhabit. Strange cancerous additions were flocked onto the sides of stately manors, mazes drawn in stone over entire grounds. Strange piping echoed from one dark entranceway, the rushing sound of wings from another. At one point Venera and Garth crossed a line of strange footprints, all the toes pointed inward and the indentations heavy on the outside as if the dozens of people who had made them were all terribly bow-legged.

It did no good to look away from these sights. Venera occasionally glanced at the sky, but the sky was paved with yet more estates. After each glance she would hunch unconsciously away, and each time, a pulse of anger would shoot through her and she would straighten her shoulders and scowl.

Venera couldn't hide her nervousness. "Is it much further?"

"You whine like a child. This way. Mind the nails."

"Garth, you remind me of someone but I can't figure out who."

"Ah! A treasured lover, no doubt. The one that got away, perhaps?—Wait, don't tell me, I prefer to wallow in my fantasies."

". . . A particularly annoying footman my mother had?"

"Madam, you wound me. Besides, I don't believe you."

"If there really is a way off of Spyre, why haven't you ever taken it?"

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He stopped and looked back at her. Little more than a silhouette in the dim light, Diamandis still conveyed disappointment in the tilt of his shoulders and head. "Are you deliberately provoking me?"

Venera caught up to him. "No," she said, putting her fists on her hips. "If this exit is so dangerous that you chose not to use it, I want to know."

"Oh. Yes, it's dangerous—but not that dangerous. I could have used it. But we've been over this. Where would I go? One of the other principalities? What use would an old gigolo be there?"

"—Let the ladies judge that."

"Ha! Good point. But no. Besides, if I circled around and came back to Lesser Spyre, I'd eventually be caught. Have you *been* up there? It's even more paranoid and tightly controlled than this place. The city is . . . impossible. No, it would never work."

As was typical of her, Venera had been ignoring what Garth was saying and focusing instead on how he said it. "I've got it!" she said. "I know why you stayed."

He turned toward her, a black cutout against distant lights—and for once Venera didn't simply blurt out what was on her mind. She could be perfectly tactful when her life depended on it but in other circumstances had never known why one should bother. Normally she would have just said it: *You're still in love with someone.* But she hesitated.

"In there," said Diamandis, pointing to a long, low building whose roof was being overtaken by lopsided trees. He waited, but when she didn't say anything he turned slowly and walked in the direction of the building.

"A wise woman wouldn't be entering such a place unescorted," said Venera lightly as she took his arm. Diamandis laughed.

"I am your escort."

"You, Mr. Diamandis, are why escorts were invented."

Pleased, he developed a bit of a bounce to his step. Venera, though, wanted to slow down—not because she was afraid of him or what waited inside the dark. At this moment, she could not have said what made her hesitate.

The concrete lot was patched with grass and young trees and they scuttled across it quickly, both wary of any watchers on high. They soon reached a peeled-out loading door in the side of the metal building. There was no breeze outside, but wind was whistling around the edges of the door.

"It puzzles me why there isn't a small army of squatters living in places like this," said Venera as the blackness swallowed Diamandis. She reluctantly stepped after him into it. "The pressures of life in these pocket states must be intolerable. Why don't more people simply leave?"

"Oh, they do." Diamandis took her hand and led her along a flat floor. "Just a bit further, I have to find the door . . . through here." Wind buffeted her from behind now. "Reach forward . . . here's the railing. Now, follow that to the left."

They were on some sort of catwalk, its metal grating ringing faintly under her feet.

"Many people leave," said Diamandis. "Most don't know how to survive outside of the chambers where they were born and bred. They return, cowed; or they die. Many are shot by the sentries, by border guards, or by the preservationists. I've buried a number of friends since I came to live here."

Her eyes were starting to adjust to the dark. Venera could tell that they were in a very large room of some sort, its ceiling ribbed with girders. Holes let in faint light in places, just enough to sketch the dimensions of the place. The floor . . .

There was no floor, only subdivided

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metal boxes with winches hanging over them. Some of those boxes were capped by fierce vortices of wind that collectively must have scoured every grain of grit out of the place. Looking down at the nearest box, Venera saw that it was really a square metal pit with clamshell doors at its bottom. Those doors vibrated faintly.

"Behold the bomb bays," said Diamandis, sweeping his arm in a dramatic arc. "Designed to rain unholy fire on any fleet stupid enough to line itself up with Spyre's rotation. This one chamber held enough firepower to carpet a square mile of air with bombs. And there were once two dozen such bays."

The small hurricane chattered like a crowd of madmen; the bomb bay doors rattled and buzzed in sympathy. "Was it ever used?" asked Venera.

"Supposedly," said Diamandis. "The story goes that we wiped out an entire armada in seconds. Though that could all be propaganda—if true, I can see why people outside Spyre would despise us. After all, there would have been hundreds of bombs that passed through the armada and simply kept going. Who knows what unsuspecting nations we strafed?"

Venera touched the scar on her chin.

"Anyway, it was generations ago," said Diamandis. "No one seems to care that much about us since the other great wheels disintegrated. We're the last, and ignored the way you pass by the aged. Come this way."

They went up a short flight of metal steps to a catwalk that extended out over the bays. Diamandis led Venera halfway down the long room; his footfalls were steady, hers slowing as they approached a solitary finned shape hanging from chains above one of the bays.

"That's a bomb!" It was a good eight feet long, almost three in diameter, a great metal torpedo with a button nose. Diamandis leaned out over the railing and slapped it.

"A bomb, indeed," he said over the whistling gale. "At least, it's a bomb casing. See? The hatch there is unscrewed. I scooped out the explosives years ago; there's room for one person if you wriggle your way in. All I have to do is throw a lever and it will drop and bang through those doors. Nothing's going to stop you once you're outside, you can go a few hundred miles and then light out on your own."

She too leaned out to touch the cylinder's flank.

"So you'll go home, will you?" he asked, with seeming innocence.

Venera snatched her fingers back. She crossed her arms and looked away.

"The people who ran this place," she said after a while. "It was one of the great nations, wasn't it? One of the ones that specialize in building weapons. Like Sacrus?"

He laughed. "Not Sacrus. Their export is *leverage*. Means of political control, ranging from blackmail to torture and extortion. They have advisors in the throne rooms of half the principalities."

"They sell torturers?"

"That's one of the skills they export, yes. Almost nobody in Spyre deals with them anymore—they're too dangerous. Keep pulling coups, trying to dominate the Council. The preservationists are still hurting from their own run-in with them. You met one of theirs in Liris?" She nodded.

Diamandis sighed. "Yet one more reason for you to leave, then. Once you're marked in their ledgers, you're never safe again. Come on, I'll give you a boost up."

"Wait." She stared at the black opening in the metal thing. The thought came to her: ***this won't work***. She could not return to Slipstream and pretend that things that had been done had not been done. She could not in silence retire as the shunned wife of a disgraced admiral. Not when the man

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responsible for Chaison's death—the Pilot of Slipstream—still sat like a spider at the center of Slipstream affairs.

Thinking this made her fury catch like dry tinder. A spasm of pain shot up her jaw, and she shook her head. Venera turned and walked back along the catwalk.

Diamandis hurried after her. "What are you doing?"

Venera struggled to catch her breath. She would need resources. If she was to avenge Chaison, she would need power. "Yesterday you said something about a fourth choice, Garth." She rattled down the steps and headed for the door.

"Tell me about that choice."

You must be ready for this, Garth had said. *It is like no place you have ever been or ever imagined.* Near dawn, as they approached the region of Spyre known as the *airfall,* she began to understand what he meant.

The great estates dwindled as they threaded their way through Diamandis's secret ways; even the preservationists avoided this sector of the great wheel. Ruins dotted the landscape and strange trees lay nearly prone like supplicants.

The ground shook, a constant wavering shudder. The motion reminded her with every step that she stood on thin metal sheeting above an abyss of air. She began to see patches of speed ivy atop broken cornices and walls. And the loose soil thinned until they walked atop the metal of the wheel itself.

Wind pushed at her from behind; Venera had to consciously set her feet down, grinding them into the grit to prevent herself starting to run. Giving into that run would be fatal, Diamandis assured her. The reason why emerged slowly, horribly, from around the collapsed walls and tangled groves of once-great estates.

She clapped Diamandis on the shoulder and pointed. "How long ago?"

He nodded and leaned in so that she could hear him over the roar. "A question important to our enterprise. It happened generations ago, in a time of great unrest in the principalities. Back when the great nations of Spyre still traveled—before they began to hide in their fortresses."

A hundred yards or so of slick decking extended past the last broken stones, then the first tears and gaps appeared. Long sheets of humming metal extended out, following the lines of the girders that underlay Spyre's upper skin. Soon even they disappeared, leaving only bright shreds and the girders themselves. A latticework of metal beams was all the ground there was for the next mile.

Below the plain of girders dark clouds shot past with dizzying speed. Propelled by Spyre's centrifugal force, a ceaseless hurricane roared in and down and through the empty windows of the broken ruins and leaped off the edges of the world.

"Behold the airfall!" Diamandis gestured dramatically; but there was no need. Venera stood awestruck at the sheer savagery of the permanent storm that warred about her. If she lifted one foot or straightened her back she might be caught and yanked out and then down, and shot out of Spyre through this screaming, gouting wound.

"This—this is insane!" She hunkered down, clutching a boulder. Her leathers flapped up around her ears. "Am I expected to run into that?"

"No, not run! Crawl. Because up there—do you see it? There is your fourth alternative!" She squinted where he pointed and at first didn't see anything. Then she blinked and looked again.

The skin of Spyre had been stripped away for at least a mile in every direction. The hole must have unbalanced the whole wheel—towers, farms, fac-

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tories, and even perhaps whole towns being sucked out and flung into the depths of Virga in a catastrophe that threatened to destroy the entire wheel. For some reason the peeling and collapse had propagated only so far and then stopped—but the standing cyclone of exiting air must have shaken Spyre so much as to threaten its immediate destruction.

This, if anything, explained the preservationists and the fierce war they had fought to lay their tracks around Spyre. The unstable wobble of the wheel could only be fixed by moving massive weights around the rim to balance it. There was no patching this hole.

Everything above had been sucked out as the skin peeled away—except in one place. One solitary tower still stood a quarter mile into the plain of girders. It had the great fortune to have been built overtop a main intersection point for Spyre's skeletal system. Also, the place might once have been a factory with its own reinforced foundation, for Venera could see huge pipes and tanks splayed like the roots of a tree below the girders. The tower itself was dark as the clouds that framed it, and it slowly swayed under the force of the winds. The girders bounced it like an acrobat in a net.

Just looking at it made her nauseated. "What *is* that?"

"Buridan Tower," said Diamandis. "It's our destination."

"Why? And how are we going to get there through . . . through *that?*"

"Using our courage, Lady Fanning—and my knowledge. I know a way, if you'll trust me. As to why—that is a secret that *you* will reveal, to both of us."

She shook her head, but Venera had no intention of backing out now. To do anything else but go forward in this mad adventure would be to invite relaxation—and thought. Grief drove her on, an active refusal to think. She waited, eyes tearing from the wind, and eventually Diamandis nodded sharply and gestured *come on.*

They crept across the last acre of intact skin, grabbing onto every rock and jammed tree branch that might offer purchase. As they approached a great split in the metal sheeting, Venera saw where Diamandis was going, and she began to think that this passage might be possible after all.

Here, a huge pipe ran under Spyre's topsoil and skin. It was anchored to the girders by rusting metal straps and had broken in places, but extended out below the skinless plain. It seemed to head straight for swaying Buridan Tower.

Diamandis had found a hole in the pipe that was sheltered by a tortured dune. He let himself down into the black mouth and she followed; instantly the wind subsided to a tolerable scream.

"I'm not even going to ask how you found this," she said after dusting herself off. He grinned.

The pipe was about eight feet across. Sighting down it she beheld, in perspective, a frozen vortex of discolored metal and sedimented rime. Behind her it was ominously dark; ahead, hundreds of gaps and holes let in the welling light of Candesce. In this new illumination, Venera eyed their route critically. "There's whole sections missing," she pointed out. "How do we cross those?"

"Trust me." He set off at a confident pace.

What was there to do but follow?

The pipe writhed in sympathy with the twisting of the beams. The motion was uncomfortable, but not terrifying to one who had ridden warships through battle, walked in gravities great and small throughout Virga, and even penetrated the mysteries of Candesce—or so Venera told herself, up until the tenth time her hand darted out of its own accord to grip white

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knuckled some peel of rust or broken valve-rim. Rhythmic blasts of pain shot up her clenched jaw. An old anger, born of helplessness, began to take hold of her.

The first gaps in the pipe were small, and thankfully overhead. The ceiling opened out in these places, allowing Venera to see where she was—which made her duck her head down and continue on with a shudder.

But then they came to a place where most of the pipe was simply gone, for a distance of nearly sixty feet. Runnels of it ran like reminders above and to the sides, but there was no bottom anymore. "Now what?"

Diamandis reached up and tugged a cable she hadn't noticed before. It was bright and strong, anchored here and somewhere inside the black cave where the pipe picked up again. Near its anchor point the line was gathered up and pinched by a huge spring, allowing it to stretch and slacken with the twisting of the girders.

"You did this?" He nodded; she was impressed and said so. Diamandis sighed. "Since I've had no audience to brag to, I've done many feats of daring," he said. "I did none in all the years when I was trying to impress the ladies—and none of them will ever know I was this brave."

"So how do we . . . Oh." Despite her pounding headache, she had to laugh. This was a zip line; Diamandis proposed to clip rollers to it and glide across. Well, at least the great girder provided a wall to one side and partial shelter above. The wind was not quite so punishing here.

"You have to be fast!" Diamandis was fitting a pulley-hold onto the cable. "You can't breathe in that wind. If you get stranded in the middle you'll pass out."

"Wonderful." But he'd strapped her into the harness securely, and falling was not something that frightened people who lived in a weightless ocean of air. When the time came she simply closed her eyes and kicked off into the white flood.

They had to repeat this process six times. Now that he had someone to give up his secret to, Diamandis was eager to tell her how he had used a powerful foot-bow to shoot a line across each gap, trusting to its grip in the deep rust on the far side to allow him to scale across once. After stronger lines were affixed it was easy to get back and forth.

So, walking and gliding, they approached the black tower.

In some places its walls fell smoothly into the abyss. In others, traces of ground still clung tenaciously where sidewalks and outbuildings had once been. They clambered out of the pipe onto one such spot; here, thirty feet of gravel and plating stretched like a splayed hand up to the tower's flank. Diamandis had strung more cables along that wall, leading toward a great dark shadow that opened halfway around the wall's curve. "The entrance!" Battered by wind, he loped over to the nearest line.

The zip lines in the pipe had given Venera the false impression that she was up for anything. Now she found herself hanging onto a cable with both hands—small comfort to also be clipped to it—while blindly groping for purchase on the side of a sheer wall, above an infinite drop now illuminated by full daylight.

Only a man with nothing to lose could have built such a pathway. She understood, for she felt she was in the same position. Gritting her teeth and breathing in shallow sips in vortices of momentary calm caused by the jutting brickwork, she followed Diamandis around Buridan Tower's long curve.

At last she stood, shaking, on a narrow ledge of stone. The door before her was strapped iron, fifteen feet tall, and framed with trembling speed ivy. Rusting machine guns poked their

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snouts out of slits in the stone walls surrounding it. A coat of arms in the ancient style capped the archway. Venera stared at it, a brief drift of puzzlement surfacing above her apprehension. She had seen that design somewhere before.

"I can't go back that way. There has to be another way!"

Diamandis sat down with his back to the door and gestured for her to do the same. The turbulence was lessened just enough there that she could breathe. She leaned on his shoulder. "Garth, what have you done to us?"

He took some time to get his own breath back. Then he jabbed a thumb at the door. "People have been pointing their telescopes at this place for generations, all dreaming of getting inside it. Secret expeditions have been mounted to reach it, but none of them ever came via the route we just took. It's been assumed that this way was impossible. No . . ." He gestured at the sky. "They always climb down the elevator cable that connects the tower to Lesser Spyre. And every time they're spotted and shot by Spyre sentries."

"Why?"

"Because the Nation of Buridan is not officially defunct. There are supposed to be heirs, somewhere. And the product of Buridan still exists, on farms scattered around Spyre. No one is legally allowed to sell it until the fate of the nation is determined once and for all. But the titles, the deeds, the proofs of ownership and provenance . . ." He thumped the iron with his fist. "They're all in here."

Her fear was beginning to give way to curiosity. She looked up at the door. "Do we knock?"

"The legend says that the last members of the nation live on, trapped inside. That's nonsense, of course; but it's a useful fiction."

It began to dawn on her what he had in mind. "You intend to play on the legends."

"Better than that. I intend to prove that they are true."

She stood up and pushed on the door. It didn't budge. Venera looked around for a lock, and after a moment she found one, a curious square block of metal embedded in the stone of the archway. "You've been here before. Why didn't you go in?"

"I couldn't. I didn't have the key and the windows are too small."

She glared at him. "Then why . . . ?"

He stood up, smiling mysteriously. "Because now I do have the key. You brought it to me."

"I . . . ?"

Diamandis dug inside his jacket. He slid something onto his finger and held it up to gleam in the light of Candesce.

One of the pieces of jewelry Venera had taken from the hoard of Anetene had been a signet ring. She had found it in the very same box that had contained the Key to Candesce. It was one of the pieces that Diamandis had stolen from her when she first arrived here.

"That's mine!"

He blinked at her tone, then shrugged. "As you say, Lady. I thought long and hard about playing this game myself, but I'm too old now. And anyway, you're right. The ring is yours." He pulled it off his finger and handed it to her.

The signet showed a fabulous ancient creature known as a "horse." It was a gravity-bound creature and so none now lived in Virga—or were they the product that Buridan had traded in? Venera took the heavy ring and held it up, frowning. Then she strode to the lock-box and placed the ring into a like-shaped indentation there.

With a mournful grating sound, the great gate of Buridan swung open.

8

Gunner Twelve-Fifteen wrapped his fingers around the dusty emergency switch and pulled as hard as he could.

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With a loud snap, the red stirrup-shaped handle came off in his hand.

The gunner cursed and half-stood to try and retrieve the end of the emergency cord that was now poking out of a hole in his canopy. He banged his head on the glass and the whole gun emplacement wobbled causing the cord to flip out into the bright air. Meanwhile, the impossible continued to happen outside; the thing was now a quarter mile above him and almost out of range.

Gunner Twelve-Fifteen had sat here for sixteen years now. In that time he had turned the oval gun emplacement from a cold and drafty purgatory into a kind of nest. He'd stopped up the gaps in the metal armor with cloth and, later, pitch. He'd snuck down blankets and pillows and eventually even took out the original metal seat, dropping it with supreme satisfaction onto Greater Spyre two miles below. He'd replaced the seat with a kind of reclining divan, built sun-shades to block the harsher rays of Candesce, and removed layers of side armor to make way for a bookshelf and drinks cabinet. The only thing he hadn't touched was the butt of the machine gun itself.

Nobody would know. The emplacement, a metal pod suspended above the clouds by cables strung across Greater Spyre, was his alone. Once upon a time there had been three shifts of sentries here, a dozen eyes at a time watching the elevator cable that ran between the town wheels of Lesser Spyre and the abandoned and forlorn Buridan Tower. With cutbacks and rescheduling, the number had eventually gone down to one: one twelve-hour shift for each of the six pods that surrounded the cable. Gunner Twelve-Fifteen had no doubt that the other gunners had similarly renovated their stations; the fact that none were now responding to the emergency meant that they were not paying any attention to the object they were here to watch.

Nor had he been; if not for a random flash of sunlight against the beveled glass of a wrought-iron elevator car he might never have known that Buridan had come back to life—not until he and the other active sentries were hauled up for court-martial.

He pushed back the bulletproof canopy and made another grab at the frayed emergency cord. It dangled three inches beyond his outstretched fingers. Cursing, he lunged at it and nearly fell to his death. Heart hammering, he sat down again.

Now what? He could fire a few rounds at the other pods to get their attention—but then he might kill somebody. Anyway, he wasn't supposed to fire on *rising* elevators, only objects coming down the cable.

The gunner watched in frozen indecision until the elevator car pierced another layer of cloud and disappeared. He was doomed if he didn't do something right now—and there was only one thing to do.

He reached for the other red handle and pulled it.

In the original design of the gun emplacements, the ejection rocket had been built into the base of the gunner's seat. If he was injured or the pod was about to explode, he could pull the handle and the rocket would send him, chair and all, straight up the long cable to the infirmary at Lesser Spyre. Of course, the original chair no longer existed.

The other gunners were startled out of their dozing and reading by the sudden vision of a pillowed divan rising into the sky on a pillar of flame. Blankets, books and bottles of gin twirled in its wake as it vanished into the gray.

The daywatch liaison officer shrieked in surprise when Gunner Twelve-Fifteen burst in on her. The canvas she had been carefully daubing paint onto now had a broad blue slash

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across it.

She glared at the apparition in the doorway. "What are *you* doing here?"

"Begging your pardon, ma'am," said the trembling soldier. "But Buridan has reactivated."

For a moment she dithered—the painting was ruined unless she got that paint off it right now—then was struck by the image of the man standing before her. Yes, it really *was* one of the sentries. His face was pale and his hair looked like he'd stuck it in a fan. She would have sworn that the seat of his leather flight suit was smoking. He was trembling.

"What's this about, man?" she demanded. "Can't you see I'm busy?"

"B-Buridan," he stammered. "The elevator. It's rising. It may already be here!"

She blinked, then opened the door fully and glanced at the rank of bellpulls ranked in the hallway. The bells were ancient and black with tarnish and clearly none had moved recently. "There was no alarm," she said accusingly.

"The emergency cord broke," said the gunner. "I had to eject, ma'am," he continued. "There was, uh, cloud, I don't think the other sentries saw the elevator."

"Do you mean to say that it was cloudy? That you're not sure you *saw* an elevator?"

He turned even more pale; but his jaw was set. As the liaison officer wound up to really let loose on him, however, one of the bellpulls moved. She stared at it, forgetting entirely what she had been about to say.

". . . Did you just see . . . ?" The cord moved again and the bell jiggled slightly. Then the cord whipped taut suddenly and the bell shattered in a puff of verdigris and dust. In doing so it managed to make only the faintest *tinking* sound.

She goggled at it. "That—that's the Buridan elevator!"

"That's what I was trying to—" But the liaison officer had burst past him and was running for the stairs that led up to the elevator stations.

Elevators couldn't be fixed to the moving outer rim of a town-wheel; so the gathered strands of cable that rose up from the various estates met in knotlike collections of buildings in freefall. Ropes led from these to the axes of the towns themselves. The officer had to run up a yin-yang staircase to get to the top of the town (the same stairway that the gunner had just run down); as her weight dropped the steps steepened and the rise became more and more vertical. Puffing and nearly weightless, she achieved the top in under a minute. She glanced out one of the blockhouse's gun slits in time to see an ornate cage pull into the elevator station a hundred yards away.

The gunner was gasping his way back up the steps. "Wait," he called feebly. The liaison officer didn't wait for him, but stepped to the round open doorway and launched herself across the empty air.

Two people were waiting by the opened door to the Buridan elevator. The liaison officer felt an uncanny prickling in her scalp as she saw them, for they looked every bit as exotic as she'd imagined someone from Buridan would be. Her first inclination (drummed into her by her predecessor) that any visitation from the lost nation must be a hoax, faded as one of the pair spoke. Her accent wasn't like that of anyone from Upper Spyre.

"They sent only you?" The woman's voice dripped scorn. She was of medium height, with well-defined brows that emphasized her piercing eyes. A shock of pale hair stood up from her head.

The liaison officer made a mid-air bow and caught a nearby girder to halt herself. She struggled to slow her breathing and appear calm as she said, "I am the designated liaison officer for

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Buridan-Spyre relations. To whom do I have the honor of addressing myself?"

The woman's nostrils flared. "I am Amandera Thrace-Guiles, heir of Buridan. And you? You're nobody in particular, are you . . . but I suppose you'll have to do," she said. "Kindly direct us to our apartments."

"Your . . ." The Buridan apartments existed, the officer knew that much. No one was allowed to enter, alter or destroy Buridan property until the nation's status was determined. "This way, please."

She thought quickly. It was years ago, but one day she had met one of the oldest of the watch officers in an open gallery on Wheel Seven. They had been passing a broad stretch of crumbling wall and came to a bricked-up archway. "Know what that is?" he'd asked playfully. When she shook her head he smiled and said, "Almost nobody does, nowadays. It's the entrance to the Buridan estate. It's all still there—towers, granaries, bedrooms and armories—but the other nations have been building and renovating around and over it for so long that there's no way in anymore. It's like a scar, or a callous maybe, in the middle of the city.

"Anyway, this was the main entrance. Used to have a sweeping flight of steps up to it, until they took that out and made the courtyard yonder. This entrance is the official one, the one that only opens to the state key. If you ever get any visitors from Buridan, they can prove that they are who they say they are if they can open the door behind that wall."

"Come with me," said the officer now. As she escorted her visitors along the rope that stretched toward Wheel Seven, she wondered where she was going to get a gang of navvies with sledgehammers on such short notice.

The demolition of the brick wall made just enough of a delay to allow Lesser Spyre's first ministers to show up. Venera cursed under her breath as she watched them padding up the gallery walk: five men and three women in bright silks, with serious expressions. Secretaries and hangers-on fluttered around them like moths. In the courtyard below, a crowd of curious citizens was growing.

"This had better work," she muttered to Diamandis.

He adjusted his mask. It was impossible to read his expression behind it. "They're as scared as we are," he said. "Who knows if there's anything left on the other side of that?" He nodded to the rapidly falling stones in the archway.

"Lady Thrace-Guiles!" One of the ministers swept forward, lifting his silk robes delicately over the mortar dust. He was bejowled and balding, with a fan of red skin across his nose and liver spots on his lumpish hands. "You look just like your great-great-great grandmother, Lady Bertitia," he said generously. "Her portrait hangs in my outer office."

Venera looked down her nose at him. "And you are. . . ?"

"Aldous Aday, acting chairman of the Lesser Spyre Committee for Public Works and Infrastructure," he said. "Elected by the Upper House of the Great Families—a body that retains a seat for you, kept draped in velvet in absentia all these years. I must say, this is an exciting and if I do say so, surprising, day in the history of Upper—"

"I want to make sure our estate is still in one piece," she said. She turned to Diamandis. "Mister Flance, the hole is big enough for you to squeeze through. Pray go ahead and tell me that our door is undamaged." He bowed and edged his way past the workmen.

He and Venera wore clothing they had found preserved in wax paper in the lockers of Buridan Tower. The styles were ancient, but for all that they were more practical than the con-

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traptions favored by Spyre's present generation. Venera had on supple leather breeches and a black jacket over a bodice tooled and inscribed in silver. A simple belt held two pistols. On her brow rested a silver circlet they had found in an upstairs bedchamber. Diamandis was similarly dressed, but his leathers were all a deep forest green.

"It's a great honor to see your nation again after so many years," continued Aday. If he was suspicious of her identity, he wasn't letting on. She exchanged pleasantries with him through clenched teeth, striving to stay in profile so that he and the others could not see her jaw. Venera had done her best to hide the scar and had bleached her hair with some unpleasant chemicals they'd found in the tower; but someone who had heard about Venera Fanning might recognize her. Did Aday and his people keep up with news from the outside world? Diamandis didn't think they did, but she had no idea at this point how far her fame had spread.

To her advantage was the fact that the paranoid societies of Spyre rarely communicated. "Sacrus won't want anyone to know they had you," Diamandis had pointed out one evening as they sat huddled in the tower, an ornate chair burning merrily in the fireplace. "If they choose to unmask you, it's at the expense of admitting they have connections with the outside world—and more importantly, they won't want to hint that they have the Key to Candesce. I don't think we'll hear a peep out of them, at least not overtly."

The workmen finished knocking down the last bricks and stepped aside just as Diamandis stuck his head around the corner of the archway. "The door is there, ma'am. And the lock."

"Ah, good." Venera stalked past the workers, trying to keep from nervously twisting the ring on her finger. This was the proverbial moment of truth. If the key didn't work . . .

The brick wall had been built across an entryway that extended fifteen feet and ended in a large iron-bound door similar to the one at Buridan Tower. The ministers crowded in behind Venera, watching like hawks as she dusted off the lockbox with her glove. "Gentlemen," she said acidly, "there is only so much air in here—though I suppose you have some natural skepticism about my authenticity. Put that out of your minds." She held up the signet ring. "I am my own proof—but if you need crass symbols, perhaps this one will do." She jammed the key against the inset impression in the lockbox.

Nothing happened.

"Pardon." Diamandis was looking alarmed and Venera quashed the urge to make some sort of joke. She must not lose her air of confidence, not even for a second. Bending to examine the lock, she saw that it had been overgrown with grit over the years. "Brush, please," she said in a bored tone, holding out one hand. After a long minute someone placed a hairbrush in her palm. She scrubbed the lock industriously for a while, then blew on it and tried the ring again.

This time there was a deep click and then a set of ratcheting thumps from behind the wall. The door ground open slowly.

"You are the council for . . . infrastructure, was it not?" she asked, fixing the ministers with a cold eye. Aday nodded. "Hmm," she said. "Well." She turned, preparing to sweep like the spoiled princess she had once been, through the opened door into blackness.

A loud *bang* and fall of dust from the ceiling made her stumble. There was sudden pandemonium in the gallery. The ministers were milling in confusion while screams and shouts followed the echoes of the explosion into

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the air. Past Aday's shoulder Venera saw a curling pillar of smoke or dust that hadn't been there a second ago.

With her foot hovering over the threshold of the estate, Venera found herself momentarily forgotten. Sirens were sounding throughout the wheel and she heard the clatter of soldiers' boots on the flagstones. In the courtyard, someone was crying; somebody else was screaming for help.

Expressionless, she walked back to the gallery and peered over Aday's shoulder. "Somebody bombed the crowd," she said.

"It's terrible, terrible," moaned Aday, wringing his hands.

"This can't have been planned," she said reasonably. "So who would be walking around on a morning like this just carrying a bomb?"

"It's the rebels," said Aday furiously. "Bombers, assassins . . . This is terrible!"

Someone burst into the courtyard below and ran toward the most injured people. With a start Venera realized it was Garth Diamandis. He shouted commands to some stunned but otherwise intact victims; slowly they moved to obey, fanning out to examine the fallen.

It hadn't occurred to Venera until this moment that she could also be helping. She felt a momentary stab of surprise, then . . . was it anger? She must be angry at Diamandis, that was it. But she remembered the mayhem of battle aboard the *Rook* when the pirates attacked, and the aftermath. Such fear and anguish, and in those moments the smallest gesture meant so much to men who were in pain. The airmen had given of themselves without a moment's thought—given aid, bandages, and blood.

She turned to look for the stairs, but it was too late: the medics had arrived. Frowning, Venera watched their white uniforms fan out through the blackened rubble. Then she lit her lantern and stalked back to the archway.

"When my manservant is done, send him to me," she said quietly. She strode alone into the long-sealed estate of Buridan.

In an abandoned bedchamber of the windswept tower, while the floor swayed and sighs moaned through the huge pipes that underlay the place, Diamandis had told Venera histories of Buridan, and more.

"They were the horse masters," he said. "Theirs was the ultimate in impractical products—a being that required buckets of food and endless space to run, that couldn't live a day in freefall. But a creature so beautiful that visitors to Spyre routinely fell in love with them. To have a horse was the ultimate sign of power, because it meant you had gravity to waste."

"But that must have been centuries ago," she'd said. Venera was having trouble hearing Diamandis, even though the room's door was tightly closed and there were no windows in this chamber. The tower was awash with sound, from the creaking of the beams and the roaring of the wind to the basso-profundo chorus of drones that reverberated through every surface. Even before her eyes had adjusted to the darkness inside the building, before she could take in the clean-stripped smell of chambers and corridors scoured by centuries of wind, the full-throated scream of Buridan had nearly driven her outside again.

It had taken them an hour to discover the source of that basso cry: the nest of huge pipes that jutted from the bottom of Buridan Tower acted like a giant wind instrument. It hummed and keened, moaned and ululated unceasingly.

Diamandis slapped the wall. This octagonal chamber was filled with jumbled pots, pans and other kitchen utensils; but it was quiet compared to the bedchambers and lounges of the for-

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mer inhabitants. "Buridan's heyday was very long ago," he said. He looked almost apologetic, his features lit from below by the oil lamp they'd brought. "But the people of Spyre have long memories. Our records go all the way back to the creation of the world."

He told her stories about Spyre's ancient glories that night as they bedded down, and the next day as they prowled the jumbled chaos of the tower. Later, Venera would always find those memories entwined within her: the tales he told her accompanied by images of the empty, forlorn chambers of the tower. Grandeur, age, and despair were the setting for his voice; grandeur, age and despair henceforth defined her impressions of ancient Virga.

He told her tales of vast machines, bigger than cities, that had once built the very walls of Virga itself. Those engines were alive and conscious, according to Diamandis, and their offspring included both machines and humans. They had settled the cold black spaces of a star's outskirts, having sailed for centuries from their home.

"Preposterous!" Venera had exclaimed. "Tell me more."

So he told her of the first generations of men and women who had lived in Virga. The world was their toy, but they shared it with beings far more powerful and wiser than themselves. It was simple for them to build places like Spyre—but in doing so, they used up much of Virga's raw materials. The machines objected. There was a war of inconceivable ferocity; Virga rang like a bell, its skin glowed with heat, and the precarious life forms the humans had seeded inside it were annihilated.

"Ridiculous!" she said. "You can do better than that."

Spyre was the fortress of the human faction, he told her. From here, the campaign was launched that defeated the machines. Sulking, they left to create their own settlement on the farside of the sun—but some remained. In faraway, frozen, and sunless corners of the world, forgotten soldiers slept. Having accumulated dust and fungus over the centuries, they could easily be mistaken for asteroids. Some hung like frozen bats from the skin of the world, icebergs with sightless eyes. If you could waken them, you might receive powers and gifts beyond mortal desire; or you could unleash death and ruin on the whole world.

The humans slowly rebuilt Virga's ecology, but they were diminished from their original, godlike power. The sons and daughters of those who had built Virga forgot their history, and wove their own myths to explain the world. Nations were spawned by the dozen, hot new suns springing into life in the black abyss. They turned their backs on the past.

Then, rumors began of something strange approaching across the cold interstellar wastes . . . a new force, spreading outwards like ripples in a pond. It came from their ancient home. It had many names, but the best description of it was *artificial nature*.

"Ah," said Venera. "I see."

They made their rounds as Diamandis talked. Each foray they made began and ended in the central atrium of the old building. Here, upward sweeping arches formed an eight-sided atrium that rose fifteen stories to the glittering stained-glass cupola surmounting the edifice. Lozenges of amber and lime, rose and indigo light outlined the dizzying succession of galleries that rose to all sides.

On the second day, as they were exploring the upper chambers, they came across traces of a story Garth Diamandis did not know. As Venera was poking her head in a closet she heard him shout in alarm. Running to his side she found him kneeling next to the armored figure of a man. The corpse was ancient, wizened and dried by the

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wind. A sword lay next to it. And in the next chamber were more bodies.

Some dire and dramatic end had come to the people here. They found a dozen mummified soldiers, all lying where they had fallen in fierce combat. Guns and blades were strewn among long-dried pools of black liquid. The disposition of the bodies suggested attackers and defenders; curious now, Venera followed the path the interlopers must have taken.

High in the tower, behind a barricaded door, a blackened human shape lay on the moldering covers of a vast four-poster bed. The white lace dress the mummy wore still moved in the wind, causing Venera to jump in startlement whenever she glanced at it.

She systematically ransacked the room while Diamandis stood contemplating the body. Here, in desk drawers and cabinets, were all the documents and letters of marque Venera needed to establish her identity. She even found a genealogy and photos. The best of the clothes were stored here as well, and that evening, rather than listening to a story, Venera began to make up her own—the story of a generations-long siege, a self-imposed exile broken finally by the last member of the nation of Buridan, Amandera Thrace-Guiles.

The darkness yielded detail slowly. Venera stood in what had once been a cobblestoned courtyard overlooked by the pillared façade of the Buridan estate. Black windows looked down from the edifice; once, sunlight would have streamed through them into whatever grand halls lay beyond. At some point in the past dark buttresses had been leaned onto the smooth white flanks of the building to support neighboring buildings—walls and arches that had swathed and overgrown it in layers, like the accumulating scales of some vast beast. For a while the estate would have still had access to the sky, for windows looked out from many of the encircling walls. All were now bricked up. Stone and wrought-iron arches had ultimately been lofted over the roofs of the estate, and at some point a last chink must have let distant sunlight in to light a forlorn cornice or the eye of a gargoyle. Then that too had been sealed and Buridan encysted, to wait.

It was understandable. There was only a finite amount of space on a town-wheel like this; if the living residents couldn't demolish the Buridan estate, they'd been determined to reach other accommodations with it.

Two glittering pallasite staircases swept up from where Venera stood, one to the left, one right. She frowned, then headed for the dark archway that opened like a mouth between them. Her feet made no sound in the deep dust.

Certainly the upstairs chambers would be the luxurious ones; they had probably been stripped. In any case she was certain she would learn more about the habits and history of the nation by examining the servants' quarters.

In the dark of the lower corridor, Venera knelt and examined the floor. She drew one of her pistols and slid the safety off. Cautiously she moved onward, listening intently.

This servants' way ran on into obscurity, arches opening off it to both sides at regular intervals. Black squares that might once have been portraits hung on the walls, and here and there sheet-covered furniture huddled under the pillars like cowering ghosts.

Sounds reached her, distorted and uncertain. Were they coming from behind or ahead? She glanced back; silhouettes were moving across the distant square of the entranceway. But that sliding sound . . . She blew out the lantern and sidled along the wall, moving by touch.

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Sure enough a fan of light draped across the disturbed dust of the corridor, and a shadow-play of figures moving against the opposite wall. Venera crept up to the open doorway and peered around the corner in time to meet the eye of someone coming the other way.

"Hey! They're here already!" The woman was younger than Venera, and had prominent cheekbones and long stringy hair. She was dressed in the dark leathers of the city. Venera leaped into her path and leveled the pistol an inch from her face.

"Don't move."

"Shills!" somebody else yelled.

Venera didn't know what a shill was, but yelled, "No!" anyway. "I'm the new owner of this house."

The stringy-haired woman was staring cross-eyed at the gun barrel. Venera spared a glance past her into a long low chamber that looked like it had originally been a wine cellar. Lanterns burned at strategic points, lighting up what was obviously somebody's hideout: there were cots, stacks of crates, even a couple of tables with maps unrolled on them. Half a dozen people were rushing about grabbing up stuff and making for an exit in the opposite wall. Several more were training guns on Venera.

"Ah." She looked around the other side of the stringy-haired head. The men with the guns were glancing inquiringly at one of their number. Though of similar age, with his flashing eyes and ironic half-smile he stood out from the rest of these youths as a professor might stand out from his students. "Hello," Venera said to him. She withdrew her pistol and holstered it, registering the surprise on his face with some satisfaction.

"You'd better hurry with your packing," she said before anyone could move. "They'll be here any minute."

The guns were still trained on her, but the confident-looking youth stepped forward, squinting at her over his own weapon. He had a neatly trimmed mustache and what looked like a dueling scar on his cheek. "Who are you?" he demanded in an amused upper-class drawl.

She bowed. "Amandera Thrace-Guiles, at your service. Or perhaps, it's the other way around."

He sneered. "We're no one's servants. And unfortunate for you that you've seen us. Now we'll have to—"

"Stow it," she snapped. "I'm not playing your game, either for your side or for Spyre's. I have my own agenda, and it might benefit your own goals to consider me a possible ally."

Again the sense of amused surprise. Venera could hear voices outside in the hall now. "Be very quiet," she said, "and snuff those lights." Then she stepped back, grabbed the edges of the doors, and shut them.

Lanterns bobbed down the corridor. "Lady Thrace-Guiles?" It was Aday.

"Here. My lantern went out. In any case there seems to be nothing of interest this way. Shall we investigate the upper floors?"

"Perhaps." Aday peered about himself in distaste. "This appears to be a commoner's area. Yes, let's retrace our steps."

They walked in silence, and Venera strained to hear any betraying noise from the chamber behind them. There was none; finally, Aday said, "To what do we owe the honor of your visit? Is Buridan rejoining the great nations? Are you going to restart the trade in horses?"

Venera snorted. "You know perfectly well there was no room to keep such animals in the tower. We had barely enough to eat from the rooftop gardens and nets we strung under the world. No, there are no horses anymore. And I am the last of my line."

"Ah." They began to climb the long-disused steps to the upper chambers. "As to your being the last of the line . . .

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lines can be rejuvenated," said Aday delicately. "And as to the horses . . . I am happy to say that you are in error in that case."

She cast a sidelong glance at him. "What do you mean? Don't toy with me."

Aday smiled, appearing confident for the first time. "There *are* horses, my lady. Raised and bred at government expense in paddocks on Greater Spyre. They have always been here, all these years. They have been awaiting your return."

9

Venera was nine-tenths asleep and imagining that the pillow she clutched was Chaison's back. Such feelings of safety and belonging were so rare for her that by contrast the rest of her life seemed a wasteland. It was as though everything she had ever done, every school lesson and contest with her sisters, every panicky interview with her father, all the manipulations and lies, had been erased by this: the quiet, his breathing, his scent, and his neck against her chin.

"Rise and shine, my lady!"

Garth Diamandis threw back the room's curtains, revealing a brick wall. He glowered at it as scraps of velvet tore away in his fingers. Dust pillared around him in the lantern-light.

Venera sat up and a knife-blade of pain shot up her jaw. "Get out!" She thrashed about for a second, looking for a weapon. "Get *out!*" Her hands fell on the lantern and—not without thinking, but rather with malicious pleasure—she threw it at him as hard as she could.

Garth ducked and the lantern broke against the wall. The candle flame touched the curtains and they caught fire instantly.

"Oh! Not a good idea!" He tore down the curtains and, fetching a poker from the fireplace, began beating the flames.

"Did you not *hear* me?" She cast the musty covers aside and ran at him. Grabbing up a broken splinter of chair-leg, she brandished it like a sword. "Get *out!*"

He parried easily and with a flick of the wrist sent her makeshift sword flying. Then he jabbed her in the stomach with the poker.

"Ooff!" She sat down. Garth continued beating out the flames. Smoke was filling the ancient bedchamber of the Buridan clan.

When Venera had her breath back she stood up and walked to a side-table. Returning with a jug of water, she upended it over the smoldering cloth. Then she dropped the jug indifferently—it shattered—and glared at Garth.

"I was asleep," she said.

He turned to her, a muscle jumping in his own jaw. She saw for the first time that his eyes were red. Had he slept?

"What's the matter?" she asked.

With a heavy sigh he turned and walked away. Venera made to follow, realized she was naked and turned to don her clothing. When she found him again he was sitting in the antechamber, fiddling with his bootstraps.

"It's her, isn't it?" she asked. "You've been looking for her?"

Startled, he looked up at her. "How did you—"

"I'm a student of human nature, Garth." She turned around. "Lace me up, please."

"You could have burned the whole place down," he grumbled as he tugged—a little too hard—on her corset strings.

"My self-control isn't good when I'm surprised," she said with a shrug. "Now you know."

"Aye." He grabbed her hips and turned her around to face him. "You usually hide your pain as well as someone twice your age."

"I choose to take that as a compli-

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ment." Conscious of his hands on her, she stepped back. "But you're evading the question—did you find her? Your expression suggests bad news."

He stood up. "It doesn't concern you." He began to walk away.

Venera gnawed her lip, thinking about apologizing for attacking him. It got no further than thinking. "Well," she said after following him for a while, "for what reason did you rouse me at such an ungodly . . ." She looked around. "What time *is* it?"

"It's midmorning." He glanced around as well; the chambers of the estate were cast in gloom save where the occasional lantern burned. "The house is entombed, remember?"

"Oh! The appointment!"

"Yes. The horse masters are waiting in the front hall. They're mighty nervous, since neither in their lifetimes nor those of their line stretching back centuries, has anyone ever audited their work."

"I'm not auditing, Garth, I just want to meet some horses."

"And you may—but we have a bigger problem."

"What's that?" She paused to look at herself in a faded mirror. Somewhere downstairs she heard things being moved; they had hired a work gang to clean the building, just before fatigue had caught up with her and forced her to take refuge in that mildewed bedchamber.

"There's a second delegation waiting for you," Diamandis explained. "A pack of majordomos from the great families."

She stopped walking. "Ah. A challenge?"

"In a manner of speaking. You've been invited to attend a Confirmation ceremony. To formally establish your identity and titles."

"Of course, of course . . ." She started walking again. "Damn, they're a step ahead of us. We'll have to turn that around." Venera pondered this as they trotted down the sweeping front steps. "Garth, do I smell like smoke?"

"Alas, my lady, you have about you the piquant aroma of a flaming curtain."

"Well, there's nothing to be done about it, I suppose. Are those the challengers?" She pointed to a group of ornately dressed men who stood in the middle of the archway. Behind them, a motley group of men in workclothes milled uncertainly. "Those would be the horsemen, then."

"Gentlemen," she said with a smile as she walked past the officials. "I'm so sorry to have kept you waiting," she said to the horsemen.

"Ahem," said an authoritative voice behind her. Venera made herself finish shaking hands before she turned. "Yes?" she said with a sweet smile. "What can I do for you?"

The graying man with the lined face and dueling scars said, "You are summoned to appear—"

"I'm sorry, did you make an appointment?"

"—to appear before the—what?"

"An appointment." She leaned closer. "Did you make one?"

Unable to ignore protocol, he said, "No," with sarcastic reluctance.

Venera waved a hand to dismiss him. "Then take it up with my manservant. These people have priority at the moment. *They* made an appointment."

An amused glint came into his eye. Venera realized, reluctantly, that this wasn't some flunky she was addressing, but a seasoned veteran of one of the great nations. And since she had just tried to set fire to her new mansion and kill her one and only friend in this godforsaken place, it could be that her judgment wasn't quite what it should be today.

She glanced at Diamandis, who was visibly holding his tongue.

With a deep sigh she bowed to the delegation. "I'm sorry. Where are my manners? If we conduct our business

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briefly, I can make my other appointment without ruffling feathers on that end as well. Who do I have the honor of addressing?"

Very slightly mollified, he said, "I am Jacoby Sarto of the nation of Sacrus. Your . . . return from the dead . . . has caused quite a stir amongst the great nations, lady. There are claims of proof that you must provide, before you are accepted for who you are."

"I know," she said simply.

"Thursday next," he said, "at four o'clock in the Council offices. Bring your proofs." He turned to go.

"Oh. Oh dear." He turned back, a dangerous look in his eye. Venera looked abjectly apologetic. "It's a very small problem—more of an opportunity, really. I happen to have become entangled in . . . a number of obligations that day. My former debtors and creditors . . . but I'm not trying to dodge your request! Far from it. Why don't we say, eight o'clock P.M., in the main salon of my home? Such a date would allow me to fulfill my obligations and—"

"Whatever." He turned to confer with the others. The conference was brief. "So be it." He stepped close to her and looked down at her, the way her father used to do when she was young. Despite herself, Venera quailed inside—but she didn't blink, just as she had never reacted to her father's threats. "No games," he said very quietly. "Your life is at stake here." Then he gestured sharply to the others and they followed him away.

Garth leaned in and muttered, "What obligations? You have nothing planned that day."

"We do now," she said as she watched Sarto and his companions walk away. She told Garth what she had in mind, and his eyes widened in shock.

"In a week? The place is a shambles!"

"Then you know what you're going to be doing the rest of the day," she said tartly. "Hire as many people as you need—cash a few of my gems. And Garth," she said as he turned to go, "I apologize for earlier."

He snorted. "I've had worse reactions first thing in the morning. But I expected better from you."

For some reason those parting words stung far more than any of the things she'd imagined he might say.

"You haven't talked about the horses," he said late that evening. Garth was pushing the far end of a hugely heavy wine rack while Venera hauled on the near side. Slowly, the wooden behemoth grated another few inches across the cellar floor. "How—oof!—what did you think of them?"

"I'm still sorting it out in my own mind," she said, pausing to set her feet better against the riveted iron decking that underlay her estate. "They were beautiful, and grotesque. *Dali* horses the handlers called them. Apparently, a Dali is any four-legged beast raised under lower gravity than it was evolved to like."

Garth nodded and they pushed and pulled for a while. The rack was approaching the wall where the little cell of rebels had made their entrance—a hole pounded in the brickwork that led to an abandoned airshaft. Garth had explored a few yards of the tunnel beyond; Venera was afraid the rebels might have left traps behind.

"It was the smell I noticed first," she said as they took another break. "Not like any fish or bird I'd ever encountered. Foul but you could get used to it, I suppose. They had the horses in a place called a paddock—a kind of slave pen for animals. But the beasts . . . they were huge!"

Voices and loud thuds filtered in from the estate's central hallway. Two of the work gangs Garth had hired that day were arguing over who should start work in the kitchens first.

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Shadows flickered past the cellar door. The estate was crawling with people now. Lanterns were lit everywhere and shouted conversations echoed down, along with hammering, sawing, and the rumble of rolling carts. Venera hoped the racket would keep the neighbors up. She had a week to make this place fit for guests and that meant working kitchens, a ballroom with no crumbling plasterwork and free of the smell of decay—and of course, a fully stocked wine cellar. The rebel gang had removed all evidence of themselves when they retreated, but had left behind the hole by which they'd gained entrance. Because the mansion only had one entrance—the back doors had not yet been uncovered—Venera had decided it prudent to keep this bolthole. But if she was going to have a secret exit, it had to *be* secret; hence the wine rack.

"Okay," she said when they had it about three feet from the wall. "I'm going to grease the floor under the hole, so we can slide the rack to one side if we need to get out in a hurry." She plonked down the can she'd taken from one of the workmen and rolled up her sleeves.

"We'll have to survey for traps some time," he said reasonably.

Venera squinted up at him. "Maybe, but not tonight. You look like you're about to collapse, Garth. Is it the gravity?"

He nodded, wincing. "That, and simple age. This is more activity than I've had in a long while, when you factor in the new weight. I thought I was in good shape, but . . ."

"Well, I hereby order you to take two days off. I'll manage the workmen. Take one day to rest up, and maybe on the second you tend to the . . . uh, that matter that you won't talk to me about."

"What matter?" he said innocently.

"It's all right." She smiled. "I understand. You've been in exile for a long time. Plenty of time to think about the men who put you there. Given that much time, I'd bet you've worked out your revenge in exquisite detail."

Garth looked shocked. "Revenge? No, that's not—oh, I suppose in the first few months I thought about it a lot. But you get over anger, you know. After a few years, perspective sets in."

"Yes, and that's the danger, isn't it? In my family, we were taught to nurture our grudges lest we forget."

"But why?" He looked genuinely distressed for some reason.

"Because once you forgive," she said, as if explaining something to a small child, "you set yourself up for another betrayal."

"That's what you were taught?"

"Never let an insult pass," she said, half-conscious that she was reciting lines her father and sisters had spoken to her many times. She ticked the points off on her fingers. "Never let a slight pass, never forget, build realistic plans for your revenges. You're either up or down from other people and you want always to be up. If they hurt you, you *must* knock them down."

Now he looked sad. "Is that why you're doing all this?" He gestured at the walls. "To get back at someone?"

"To *get back,* at all," she said earnestly, "I must have my revenge. Else I am brought low forever and can never go home. For otherwise—" Her voice caught.

For otherwise, I have no reason to return.

His expression, of compassion, would have maddened her on anyone else. "You were telling me about the horses," he said quietly.

"Ah. Yes." Grateful of the distraction, she said, "Well, they have these huge barrel-shaped bodies and elegant long necks. Long heads like on my ring." She held it up, splaying her fingers. "But their legs! Garth, their legs are twice the length of their bodies—like spider's legs, impossibly long and

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thin. They stalked around the paddock like . . . well, like spiders! I don't know how else to describe it. They were like a dream that's just tipping over to become a nightmare. I'm not sure I want to see them again."

He nodded. "There are cattle loose between some of the estates. I've seen them, they look similar. You have to understand, there's no room on the city wheels to raise livestock."

Venera pried open the lid of the grease can and picked up a brush. "But now that the nation of Buridan has returned, the horses are our responsibility. There are costs . . . it seems a dozen or more great nations have acted as caretakers for one or another part of the Buridan estate. Some are tenants of ours who haven't paid rent in centuries. Others are like Guinevera, who've been tending the horses. There's an immense web of relationships and dependencies here, and we have a little under a week to figure it all out."

Garth thought about it for a while. "First of all," he said eventually, "you need to bring a foal or two up here and raise it in the estate." He grimaced at her expression. "I know what I just said, but it's an important symbol. Besides, these rooms will just fill up with people if you give them a chance. Why not set some aside for the horses now?"

"I'll think about that."

They cleared out the space behind the rack, and slid it against the wall. It fit comfortably over the exit hole. As they stood back to admire their work, Garth said, "It's a funny thing about time, you know. It sweeps away anger and hate. But it leaves love untouched."

She threaded her hand through his arm. "Ah, Garth, you're so sentimental. Did it ever occur to you that's why you ended up scrabbling about on Greater Spyre for the past twenty years?"

He looked her in the eye. "Truthfully, no. That had never occurred to me. If anything, I'd say I ended up there because I didn't love well enough, not because I ever loved too well."

She sighed. "You're hopeless. It's a good thing I'm here to take care of you."

"And here I thought it was I taking care of you."

They left the cellar and re-entered the bedlam of construction that had taken over the manor.

The headache began that night.

Venera knew exactly what it was, she'd suffered these before. All day her jaw had been bothering her; it was like an iron hand was inside her throat, reaching up to clench her skull. Around dinner a strange pulsating squiggly spot appeared in her vision and slowly expanded until she could see nothing around it. She retired to her room, and waited.

How long was this one going to last? They could go on for days, and she didn't have days. Venera paced up and down, stumbling, wondering whether she could just sleep it off. But no, she had mounds of paperwork to go through and no time.

She called Garth. He exclaimed when he saw her and ran to her side. "You're white as a new wall!"

"Never mind," she said, detaching herself from him and climbing into bed. "Bring in the accounts books. It's just a headache, I get them. I'm sick but we need to go through these papers."

He started to read the details of Buridan's various contracts. Each word was like a little explosion in her head. Venera tried to concentrate, but after ten minutes she suddenly leaned over the edge of the bed and retched.

"You need to sleep!" His hands were on her shoulders. Garth eased her back on the bed.

"Don't be ridiculous," she mumbled. "If we don't get this stuff straight, we

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won't convince the council and they'll cart us both away in chains." A blossom of agony had unfurled behind her left eye. Despite her brave words Venera knew she was down for however long the migraine decided to hold her.

Garth darkened the lamps and tiptoed around while she lay sprawled like a discarded doll. Distant hammering sounded like it was coming from inside her own head, but she couldn't hold up the renovations.

Sleep eventually came, but she awoke to pain that was abstract only until she moved her head and opened one eye. *This is how it's going to be.* These headaches were the bullet's fault; when it smashed her jaw it had tripped some switch inside her head and now agony ambushed her at the worst times. Always before, she'd had the safe haven of her bedroom at home to retreat to—her time on the *Rook* had been mercifully free of such episodes. She used such times to indulge in her worst behavior: whining, accusing, insulting anyone who came near her, and demanding that her every whim be catered to. She wallowed in self-pity, letting everyone know that she was the sad victim of fate and that no one, ever, had felt the agonies she was enduring so bravely.

But she really was going to die if she let the thing rule her this time. It wasn't that there was nobody around to indulge her; but all the sympathy in the world wasn't going to save her life if she didn't follow through on the deception she and Garth had planned. So, halfway through morning, Venera resolutely climbed out of bed. She tied a silk sash over her eyes, jammed candle wax in her ears, and picked up an empty chamber pot. Carrying this, she tottered out of the room. "Bring me a dressing gown," she said in reply to a half-heard question from a maid. "And fetch Master Flance."

Blindfolded, half deaf, she nonetheless managed to make her rounds of the work crews, while Garth followed her and read from the books. She told him what points to underline for her to look at later; inquired of the work and made suggestions; and, every now and then, she turned aside to daintily vomit into the chamber pot. Her world narrowed down to the feel of carpet or stone under her feet, the murmur of words in her ear, and the cataclysmic pounding that reverberated inside her skull. She kept going by imagining herself whipping, shooting, stomping on, and setting fire to Jacoby Sarto and the rest of this self-important council who had the temerity to oppose her will. This interior savagery was invisible from without, as she mumbled and queried politely, and let herself be led about passively.

All of this busywork seemed to be getting her somewhere, but that evening when she collapsed onto her bed, Venera realized that she had no memory of anything she had said or done today. It was all obscured by the angry red haze of pain that had followed her everywhere.

She was doomed. She'd never be ready in time for the interrogation the council had planned. Venera rolled over, cried into her pillow, and finally just lay there, accepting her fate. The bullet had defeated her.

With that understanding came a kind of peace, but she was in too much pain to analyze it. She just lay there, dry eyed, frowning, until sleep overcame her.

10

"What is *this?*" Jacoby Sarto glared at the rickshaws clustering in the courtyard below the Buridan estate's newly-rebuilt entrance. It was seven P.M. and Candesce was extinguishing itself, its amber glories drenching the buildingtops. Down in the purpled courtyard the upstart princess's new footmen were lighting lanterns to guide in dozens of carts and palanquins from

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the crowded alley.

Someone of a minor noble nation had heard him and turned, smirking. "You didn't receive an invitation?" asked the impertinent youth. "It's a gala reception!"

"Bah!" Sarto turned to his companion, the Duke of Ennersin. "What is she up to? This is a feeding frenzy. I'll wager half these people have come to gawk at the legendary Buridans, and the other half to watch us drag her out of the place in chains. What does she gain out of such a spectacle?"

"I'm afraid we'll find out shortly," said the duke. He was as stocky as Sarto, with similar graying temples and the sort of paternal scowl that could freeze the blood of anyone under forty. Together the two men radiated gravitas, to such an extent that the crowds automatically parted for them. True, most of those assembling here knew them, by sight and reputation at least. The nations of Sacrus and Ennersin were feared and respected by all—all, it seemed, save for newly reborn Buridan. These two were here tonight to make sure that this new situation didn't last.

"In any case, such entertainments as this are rare, Jacoby," continued Ennersin. "It's sure to attract the curious and the morbid, yes. But it's the third audience that worries me," Duke Ennersin commented as they strode up the steps to the entrance.

Sarto glared at a footman who had the temerity to approach them at the entrance. "What third audience?"

"Do you see the Guineveras there? They've been keeping Buridan's horses for generations. Make no mistake, they'd be happy to be free of the burden—or to own the beasts outright."

"Which they will after tonight."

"I wouldn't be too sure of that," said Ennersin. "Proof that this Amandera Thrace-Guiles is an imposter is not proof that the real heirs aren't out there."

"What are you saying, man? She's been in the tower! Clearly it's empty after all. There are no heirs to be had."

"Not there, no . . . But don't forget there are sixteen nations that claim to be related by blood to the Thrace-Guileses. The moment this Amandera's declared a fake the other pretenders will pounce on the property rights. It'll be a legal free-for-all—maybe even a civil war. Many of these people are here to warn their nations the instant it becomes a possibility."

"Ridiculous!" Sarto forgot what he was going to say next, as they entered the lofting front hall of the Buridan estate.

It smelled of fresh paint and drying plaster. Lanterns and braziers burned along the pillared staircases, lighting a frescoed ceiling crawling with allegorical figures. The painted blues, yellows, and reds were freshly cleaned and vibrant to the point of being nauseating, as were the heroic poses of the men and half-clad women variously hanging off, riding, or being devoured by hundreds of ridiculously-posed horses. Sarto gaped at this vision for a while, then shuddered. "The past is sometimes best left buried," he said.

Ennersin chuckled. "Or at least strategically unlit."

Sarto had been expecting chaos inside the estate; after all, nobody had set foot in here in centuries, so Thrace-Guiles's new servants would be unfamiliar with the layout of their own home. They would be a motley collection of rejects and near-criminals hired from the dregs of Lesser Spyre, after all, and he fully expected to see waiters spilling drinks down the decolletage of the ladies when they weren't banging into one another in their haste to please.

There was none of that. Instead, a string quartet played a soothing pavane in the corner, while men and women in black tails and white gloves glided to and fro, gracefully presenting

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silver platters and unobtrusively refilling casually tilted glasses. The wait staff were, in fact, almost mesmerizing in their movements; they were better than Sarto's own servants.

"Where did she get this chattel?" he muttered as a man with a stentorian voice announced their arrival. Lady Pamela Anseratte, who had known Sarto for decades and was quite unafraid of him, laughed and trotted over in a swirl of skirts. "Oh, she's a clever one, this Thrace-Guiles," she said, laying her lace-covered hand on Sarto's arm. "She's hired the acrobats of the Spyre Circus to serve drinks! I hear they rehearsed blindfolded."

Indeed, Sarto glanced around and realized there was a young lady with the compact muscled body of a dancer standing at his elbow. She held out a glass. "Champagne?" Automatically, he took it, and she vanished into the crowd without a sound.

"Well, we'll credit the woman with being a genius in domestic matters," he growled. "But surely you haven't been taken in by her act, Pamela? She's an imposter!"

"That's as may be," said the lady with a flick of her fan. "But your imposter has just forgiven Virilio's debt to Buridan. It seems that with interest it would now be worth enough to outfit a small fleet of merchant ships! And she's just erased it! Here, look! There's August Virilio himself, drinking himself into happy idiocy under that stallion statue."

Sarto stared. The limestone stallion appeared to be sneering over Virilio's shoulder at the small crowd of hangers-on he was holding forth to. He was conspicuously unmasked, like most of the other Council representatives. The place was crowded with masked faces, though—some immediately identifiable, others unfamiliar even to his experienced eye. "Who are all these people?" he wondered aloud.

"Debtors, apparently," said Lady Pamela with some relish. "And creditors . . . everyone who's taken care of Buridan's affairs, or profited by their absence, over the past two hundred years. They all look . . . happy, don't you think, Jacoby?"

Ennersin cleared his throat and leaned in to say, "Thrace-Guiles has clearly been doing her homework."

Despite himself, Sarto was impressed. This woman had confounded his expectations. Was it possible that she might continue to do so? The thought was unexpected—and nothing unexpected had happened in Jacoby Sarto's life in a very long time.

He resisted where this line of thought led; after all, he had his instructions. Sarto dashed his champagne glass on the floor. Heads turned. "Let her enjoy her little party," he said in his darkest voice. "Amandera Thrace-Guiles, or whatever her real name is, has about one hour of freedom left.

"And no more than a day to live."

Venera strode through the crowd, nodding and smiling. She felt unsteady and vulnerable, and though her headache had finally faded she had to rein in an automatic cringe-reaction to bright lights and loud sounds. She felt hideously unready for the evening, and had overdressed to compensate. Most of the people in Spyre wore dark colors, so she had chosen to dress in red—her corset was a glossy crimson inset with designs sewn in scarlet thread, with a wide-shouldered, open jacket atop that. She wore a necklace from the Anetene hoard. Her skin was still recovering from the burns she'd suffered near Candesce, but the contrasts were still effective. To hide the scar on her chin she'd adopted one of the strange local skullcaps, this one of black feathers. It swept up behind her ears and down to a point in the middle of her forehead, where a single red Anetene gem glowed above her heavi-

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ly drawn eyebrows—but it also thrust two small wings along her jawline. They tickled her chin annoyingly, but that was a small distraction compared with the sensations that the ankle-length skirt gave her. Dresses and skirts were considered obscene in most of Virga, where one might become weightless at any time. Back home, the prostitutes wore them. Venera wore a pair of breeches under the thing, which made her feel a bit better, but the long heavy drape still moved and turned like it had a mind of its own.

The one spot of white in her apparel was the fan she held before her like a shield. Nobody but Garth would know that its near side was covered with names and family trees, drawn in tiny spiked letters. She hadn't had time to read the complicated genealogies and financial records of Buridan and its dependents; this fan was her lifeline.

As she recovered from her migraine in the last day or so, the reconstruction work had caught up and the servants learned where everything was. To her relief Garth had orchestrated the ball without supervision, making sometimes brilliant decisions—twenty years of pent-up social appetite, she supposed. The estate's pantries had been cleared of rats and spiders and restocked; the ancient plumbing system had been largely replaced (not without messy accidents) and the gas lines to the stoves reconnected.

In a way, she was grateful for having been laid low these past few days. This afternoon she'd had a brief moment with nothing to do, and into her mind had drifted memories of Chaison. Standing in her chambers, her hand half lifted to her hair, she was suddenly miserable. Pain and anxiety had masked her grief until now.

She had to battle through it all—play her part. So now she marched up to a tight knot of masked nobles from the mysterious nation of Faddeste and bowed. "Welcome to my house. Speaking as someone who has seen few human beings in her life, outside her immediate family, I know how much it must cost you to attend a crowded event such as this."

"We find it . . . hard." The speaker could be a man or a woman, it was impossible to tell. Its accent was so thick she had to puzzle out the words. Tall and thickly robed, this ambassador from a ten-acre nation flicked a finger at the sweeping dancers now beginning to fill up the center of the hall. "Such frivolity should be banned. How are you so calm? Not raised to this, crowds should frighten."

Venera bowed. "I lived in my imagination as a girl." That much was true. "Lacking real people to talk to, I invented a whole court—a whole nation!—who followed me everywhere. I was never alone. So perhaps this isn't so strange for me."

"Doubtful. We don't believe you are of Buridan."

"Hmm. I could say the same—how do I know you're really from Faddeste?"

"Sacrilege!" But the robed figure didn't turn away.

"Whether either of us is who they say they are," said Venera with a smug smile, "it remains a fact that Buridan owes Faddeste twenty thousand Spyre sovereigns. Imposter or not, I am willing to repay that debt."

Now she stepped in close, raising one black eyebrow and glancing around at the crowd. "Do you trust the pretenders in the crowd to do the same, if they acquire the title to Buridan? Think hard on that."

The ambassador reared back as though afraid Venera would touch it. "You have money?"

"Go see Master Flance." She pointed at Garth who, despite being masked, had characteristically surrounded himself with women young and old. All were laughing at some story he was

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telling. Seeing this, for a moment Venera forgot her worries and felt a pulse of warmth for the aging dandy. She turned back to the Faddestes, but they were already maneuvering across the dance floor like a frightened but determined flock of crows.

She blew out a held breath. Seven or eight more minor nations to bribe, and only half an hour to do it in. All the members of the Spyre Council were here now. It would all be decided soon, one way or another.

Before she could reach her next target a majordomo in the livery of the Council approached and bowed. "They are ready for you upstairs, madam," he said coolly.

She kept her gaze fixed on the top of his head as she bowed in return. All eyes were on her, she was certain. This was the moment when all would be decided.

As she clattered up the marble she tried to remember the lines and gambits she had crammed into her head over the past day or so. It hadn't been enough time, and the hangover of her migraine had interfered. She was not ready; she just had herself, the passing lanterns, the looming shadows above, and the single rectangle of light from a pair of doors in the upstairs hall. She told herself to slow down, control her breathing, count to ten—but finally just cursed and strode down the newly laid crimson carpet to pivot on one heel and step into the room.

Jacoby Sarto's leonine features crinkled into something like a smirk as he saw her. He was placing the final chair behind the long conference table in the high-ceilinged minor reception hall. Damn him, he'd moved everything!—Where Venera had contrived a single long table with chairs along two sides, with her at the end, Sarto—or somebody, but it sure looked like him from his posture—had turned the table sideways, crammed all the seats on one side of it (behind it, now) and left one solitary chair in the center of the carpet. What had been a conference room was now a court, with her as the defendant.

The rest of the council was standing around behind Sarto as the servants finished the new placement.

She had an overwhelming urge to pick a seat behind the table and put her feet up, then point to the solitary position and ask, "who sits there?" Only memory of how badly her recent outbursts had gone stopped her.

Well, he had won this round, but she wasn't going to let him revel in it. Venera stopped one of the servants and said, "Bring me a side table, and a bottle of wine and a glass. Some cheese might be good too." She sat graciously in the exposed chair and draped her skirts as she'd seen the other ladies do. Then she locked eyes with Sarto, and smiled.

The others began to take their places. There were twelve of them. Jacoby Sarto of Sacrus, who was rumored to be merely an errand boy to the true heads of the family, sat on the far left. The arch-conservative duke Ennersin, who had conspicuously arrived with Sarto, sat next to him, frowning in disapproval at Venera. She could count on those two to oppose her confirmation. Of the others . . .

Pamela Anseratte was smiling at something, but wouldn't meet Venera's eye. Principe Guinevera *was* trying to meet her eye, and apparently attempting to wink; he took up two spaces at the table and his fleshy hands were planted on the tabletop as if he were, at any second, about to leap to his feet and proclaim something. Next to him sat August Virilio, who looked contented, half asleep even—and probably was, after the heroic drinking he'd gotten up to after she forgave his nation's debt. These three were on her side—or so she hoped.

The other great families were represented by minor members and, in

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three cases, by ambassadors. Two of the ambassadors were cloaked and masked; the families in question, Garrat and Oxorn, were mysterious, isolate and paranoid as only the ancients of Greater Spyre could be. Nobody knew what their nations produced—only that it went for fabulous prices and threat of death on exposure in the outside world.

Three out of twelve for sure. Maybe three others if her reckless divestment of Buridan's wealth had done what she hoped. But it was a big if. She was going to need every ounce of cunning and every resource to get through the evening free and intact.

The Council all sat and waited while Venera's new servants placed decanters of wine and tall glasses on the table. Then Pamela Anseratte stood and smiled around the table. "Welcome, everyone. I trust the nations are well and that the hospitality of our host has been sampled and appreciated by all? Yes? Then let's begin. We're gathered here tonight to decide whether to reinstate Buridan as an active nation, in the person of the woman who here claims to be Amandera Thrace-Guiles, heir of said nation. I—"

"Why are you alone?" Duke Ennersin was speaking directly to Venera. "Why are we to take this one person's word for who she is? Where is the rest of her nation? Why has she appeared here, now, after an absence of centuries?"

"Yes, yes, we're going to get to those questions," soothed Lady Anseratte. "First, however, we have some formalities to clear away. Amandera Thrace-Guiles's claim is pointless and instantly void if she cannot produce documents indicating her paternity and ancestry, as well as the notarized deeds and titles of her nation, plus the key." She beamed at Venera. "You have all those things?"

Silently, Venera rose and walked to the table. She placed the thick sheaf of papers she'd brought in front of Anseratte. Then she unscrewed the heavy signet ring from her finger and placed it atop the stack.

This was her opening move, but she couldn't count on its effect.

"I see," said Lady Anseratte. "May I examine the ring?" Venera nodded, returning to her seat. Lady Anseratte took a flat box with some lights on it and hovered it over the ring. The box glowed and made a musical *bong*ing sound.

"Duly authenticated," said the lady. She carefully placed the ring to one side and opened the sheaf. Much of its contents were genuine. Venera had found the deeds and titles in the tower. It had been the work of several careful days to extend the family tree by several centuries and insert herself at its end. She had intended to use her own not-inconsiderable talents at forgery but had been indisposed, but Garth had come through, displaying surprising skills. He was not just a gigolo in his previous life, evidently. As the papers were passed up and down the table Venera kept a bland expression on her face. She tried the wine, and adjusted the fall of her skirt again.

"Convincing," said Jacoby Sarto after flipping through the papers. "But just because something is convincing that doesn't mean it's true. It's merely convincing. What can you do to establish the *truth* of your claim?"

Venera tilted her head to one side. "It would be impossible to do so to everyone's satisfaction, sir, just as it would be impossible for you to prove that you are, without doubt, Jacoby Sarto of Nation Sacrus. I rather think the onus is on this council to disprove my claim, if they can."

August Virilio opened one eye slightly. "Why don't we start with your story? I always like a good story after supper."

"Excellent idea," said Pamela Anseratte. "Duke Ennersin asked why it is

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that you are here before us now, of all times. Can you explain why your nation has hidden away so thoroughly for so long?"

Venera actually knew the answer to that one—it had been written in the contorted bodies of the soldiers inside the tower, and in the scrawled final confessions of the dead woman in the bedchamber.

Steepling her hands, Venera smiled directly at Jacoby Sarto and said, "The answer is simple. We knew that if we left Buridan Tower, we would be killed."

This was gambit number two.

The council members expressed various shades of surprise, shock, and satisfaction at her revelation. Jacoby Sarto crossed his arms and sat back. "Who would do this?" asked Anseratte. She was still standing and now leaned forward over the table.

"The isolation of Buridan Tower wasn't an accident," said Venera. "Or, at least, not entirely. It was the result of an attack—and the attackers were two of the great nations present at this table tonight."

August Virilio smiled sleepily, but Principe Guinevera leapt to his feet, knocking his chair over. *"Who?"* he raged. "Name them, fair lady, and we will see justice done!"

"I did not come here to open old wounds," said Venera. "Although I recognize that my position here is perilous, I had no choice but to leave the tower. Everyone else there is dead—save myself and my manservant. Some bird-borne illness took the last five of our people a month ago. I consigned their bodies to the winds of Virga, as we have been doing for centuries now. Before that we were dwindling, despite careful and sometimes repugnant breeding restrictions and constant austerity . . . We lived on birds and airfish we caught with nets, and supplemented our diets with vegetables we grew in the abandoned bedrooms of our ancestors. Had I died in that place, then our enemies would truly have won. I chose a last throw of the die and came here."

"But the war of which you speak . . . it was centuries ago," said Lady Anseratte. "Why did you suppose that you would still be targeted after so long?"

Venera shrugged. "We had telescopes. We could see that our enemies' nations were thriving. And we could also clearly see that sentries armed with machine-guns ringed the tower. I was raised to believe that if we entered the elevator and tried to reach Lesser Spyre, those machine gunners would destroy us before we rose more than a hundred meters."

"Oh, no!" Guinevera looked acutely distressed. "The sentries were there for your protection, madam! They were to keep interlopers *out,* not to box you in!"

"Well." Venera looked down. "Father thought so, but he also said that we were so reduced that we could not risk a single soul to find out. And isolation . . . becomes a habit." She looked pointedly at the ambassadors of Oxorn and Garrat.

Sarto guffawed loudly. "Oh, come on! What about the dozens of attempts that have been made to contact the tower? Semaphore, loudspeakers, smoke signals, for God's sake. They've all been tried and nobody ever responded."

"I am not aware that anyone has tried to contact us during my lifetime," said Venera. This was true, as she'd learned in the past days. Sarto would have to concede the point. "And I can't speak to my ancestors' motives for staying silent."

"That's as may be," Sarto continued. "Look, I'll play it straight. Sacrus was involved in the original atrocity." He held up a hand when Guinevera protested loudly. "But gentlemen and ladies, that was centuries ago. We are prepared to admit our crime and make reparations to the council when this

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woman is exposed for the fraud that she is."

"And if she's not?" asked Guinevera angrily.

"Then to the Nation of Buridan directly," said Sarto. "I just wanted to clear the air. We can't name our co-conspirators because, after all this time, the records have been lost. But having admitted our part in the affair, and having proposed that we pay reparations, I can now continue to oppose this woman's claim without any appearance of conflict."

Venera frowned. Her second gambit had failed.

If Sacrus had wanted to keep their involvement a secret, she might have had leverage over Sarto. Maybe even enough to swing his vote. As it was he'd adroitly sidestepped the trap.

Lady Anseratte looked up and down the table. "Is the other conspirator's nation similarly honorable? Will they admit their part?" There was a long and uncomfortable silence.

"Well, then," said Pamela Anseratte. "Let us examine the details of your inheritances."

From here the interview deteriorated into minutiae as the council members pulled out individual documents and points of law and debated them endlessly. Venera was tired, and every time she blinked to clear her vision, she worried that a new migraine might be reaching to crush her. Pamela Anseratte conducted the meeting as if she had boundless energy, but Venera—and everyone else—wilted under the onslaught of detail.

Sarto used sarcasm, wit, guile, and bureaucracy to try to torpedo her claim, but after several hours it became clear that he wasn't making headway. Venera perked up a bit. *I could win this*, she realized—simultaneously realizing just how certain she'd been that she wouldn't.

Finally Lady Anseratte said, "Any further points?" and nobody answered. "Well," she said brightly, "we might as well proceed to a vote."

"Hang on," said Sarto. He stood heavily. "I've got something to say." Everyone waited.

"This woman is a fraud. We all know it. It's inconceivable that this family could have sustained themselves and their retainers for centuries within a single tower, cut off from the outside world—"

"Not inconceivable," said the ambassador of Oxorn from behind her griffin mask. "Quite possible."

Sarto glared at her. "What did they do for clothes? For even the tiniest item of utility, such as forks or pens? Do you really believe they have an entire industrial base squirreled away in that tower?" He shook his head.

"It's equally inconceivable that someone raised in such total isolation should, upon being dropped into society and all its machinations, conduct herself like a veteran! Did she rehearse social banter with her *dolls?* Did she learn to dance with her rocking horse? It's preposterous on the face of it.

"And we all know why her claim has any chance of success. It's because she's bought off everyone who might oppose it. Buridan has tremendous assets—estates, ships, buildings, and industries here and on Greater Spyre that have been administered by other nations in absentia, for generations. She's promised to give those nations the assets they've tended! For the rest, she's proposing to beggar Buridan by paying all its debts here and now. When she's done Buridan will have nothing to its name but a herd of gangly equines."

"And this house," said Venera primly. "I don't propose to give that up." There was some stifled laughter around the table.

"It's a transparent fraud!" Sarto turned to glare at the other council members. "Forget about the formal details of her claim—in fact, let it be read that there's nothing to criticize about

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it. That doesn't matter. We all know the truth. She is insulting the name of a great nation of Spyre! Do you actually propose to let her get away with it?"

He was winning them over. Venera had one last hand to play, and it was her weakest. She stood up.

"Then who am I?" She strode up to the table and leaned across it to look Sarto in the eye. "If I'm a fraud I must have come from somewhere. Was I manufactured by one of the other nations, then? If so, which one? Spyre is secretive, but not so much so that we don't all keep tabs on one another's genealogies. Nobody's missing from the rosters, are they?

"And yet!" She turned to address the rest of the council. "Gaze upon me and tell me to my face that you don't believe I am noble born." She sneered at Sarto. "It's evident in my every gesture, in how I speak, how I address the servants. Jacoby Sarto says that he *knows* I am a fraud. Yet you know I am a peer!

"So then where did I come from?" She turned to Sarto again. "If Jacoby Sarto believes I did not come from Buridan Tower, then he must have some idea of where I did. What do you know, Sir Sarto, that you're not telling the rest of us? Do you have some proof that you're not sharing? A name, perhaps?"

He opened his mouth—and hesitated.

They locked eyes and she saw him realize what she was willing to do. The Key to Candesce was almost visible in the air between them; it was the real subject of tonight's deliberations.

"Sacrus has many secrets, as we've seen tonight," she said quietly. "Is there some further secret you have, Sir Sarto, that you wish to share with the Council? A name, perhaps? One that might be recognized by the others present? A name that could be tied to recent events, to rumors and legends that have percolated through the principalities in recent weeks?" She saw puzzled frowns on several faces—and Sarto's eyes widened as he heard her tread the edge of the one revelation Sacrus did not want made public.

He looked down. "Perhaps I went too far in my accusations," he said almost inaudibly. "I retract my statements."

Duke Ennersin leaned back in his chair, openmouthed. And Jacoby Sarto meekly sat down.

Venera returned to her seat. *If I lose, everyone learns that you have the key,* she thought as she settled herself on the velvet cushion. She took a sip of wine and kept her expression neutral as Pamela Anseratte stood again.

"Well," said the lady in a cautious tone, "if there are no more outbursts . . . let us put it to a vote."

Venera couldn't help but lean forward a bit.

"All those who favor this young lady's claim, and who wish to recognize the return of Buridan to Spyre and to this Council, raise your right hand."

Guinevera's hand shot up. Beside him, August Virilio languidly pushed his into the air. Pamela Anseratte raised her own hand.

Oxorn's hand went up. Then Garrat's ambassador raised his.

That made five. Venera let out the breath she'd been keeping. It was over. She had failed—

Jacoby Sarto raised his hand.

His expression was exquisite—a mixture of distaste and resignation that you might see in a man who's just volunteered to dig up a grave. Duke Ennersin was staring at him in total disbelief, and slowly turning purple.

Lady Anseratte's only show of surprise was a minute frown. "All those opposed?" she said.

Ennersin threw his hand in the air. Five others went up.

"And no abstentions," said Anseratte. "We appear to have a tie."

Jacoby Sarto slumped back in his chair. "Well, then," he said quietly. "I

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move we take the matter to the Council investigative team. Let them visit the tower and conduct a thorough—"

"Don't I get a vote?"

They all turned to stare at Venera. She sat up straighter, clearing her throat. "Well, it seems to me . . ." She shrugged. "It's just that this meeting was called to confirm my identity and claim to being head of Buridan. Confirmation implies a presumption that I am who I say I am. I *am* Buridan unless proven otherwise. And Buridan is a member of the Council. So I should have a vote."

"This is outrageous!" Duke Ennersin had had enough. He threw back his chair and stalked around the table. "You have the temerity to suggest that you—"

"She's right."

The voice was quiet and languid, almost indifferent—but it stopped Ennersin in his tracks. His head ratcheted around slowly, as if pulled by unwilling forces to look at the man who had spoken.

August Virilio was lounging back in his chair, his hands steepled in front of him. "Article five, section twelve, paragraph two of the Charter," he said in a reasonable tone. "Identity is presumptive if there is no other proven heir. And Buridan *is* a member of the Council. Its title was never suspended."

"A mere formality! A courtesy!" But Ennersin's voice had lost its certainty. He appealed to Pamela Anseratte, but she simply spread her hands and smiled.

Then, looking around him at Venera, she said, "It appears you are right, dear. You do get a vote. Would you care to . . . ?"

Venera smiled and raised her right hand. "I vote in favor," she said.

She was sure you could hear Ennersin outside and down the street. Venera smiled as she shepherded her guests to the door. She was delirious with relief, and was sure it showed in her ridiculous grin. Her soiree was winding down, though naturally the doors and lounges would be open all night for any stragglers. But the council members were tired; no one would criticize them for leaving early.

Ennersin was yelling at Jacoby Sarto. It was music to Venera's ears.

She looked for Garth but couldn't see him at first. Then—there he was, sidling in the entrance. He'd changed to inconspicuous street clothes. Had he been preparing to sneak away? Venera pictured him leaving through the wine cellar exit to avoid the council's troops. Then he could have circled around to stand with the street rabble who were waiting to hear the results of the vote. She smiled; it was what she might have done.

There went Ennersin, sweeping by Garth without noticing him. Diamandis watched him go in distaste, then turned and saw Venera watching him. He spread his hands and shrugged. She made a dismissive gesture and smiled back.

Time to mingle; the party wasn't over yet and her head felt fine. It felt good to reinforce her win with a gracious turn about the room. For a while everything was a blur of smiling faces and congratulations. Then she found herself shaking someone's hand (the hundredth, it must have been) and looked up to find it was Jacoby Sarto's.

"Well played, Ms. Fanning," he said. There was no irony in his voice.

She glanced around. They were miraculously alone for the moment. Probably a single glance from under Sarto's wiry brows had been enough to clear a circle.

All she could think of to say was, "Thank you." It struck her as hopelessly inadequate for the situation, but all her strategies had been played out. To her surprise, Sarto smiled.

"I've lost Ennersin's confidence," he said. "It's going to take me years to re-

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gain some allies I abandoned today."

"Oh?" The mystery of his reversal during the vote deepened. Not one to prevaricate, Venera asked, "Why?"

He appeared puzzled. "Why did I vote for you?"

"No—I know why." The key was again unspoken of between them. "I mean," she said, "why did you come out so publicly against me in the first place, if you knew I had that to hang over you?"

"Ah." It was his turn to look around them. Satisfied that no one was within earshot, he said, "I was entrusted with the safety of Sacrus's assets. You're considered one of them. If I could acquire you, I was to do that. If not, and you threatened to reveal . . . certain details . . . well, I was to contrive a murderous rage." He opened his jacket slightly and she saw the large pistol he had holstered there. "You would not have had a chance to say what you know," he said with a slight smile.

"So why didn't you . . ."

"It is useful to have an acknowledged heir of Buridan controlling that estate. This way we avoid a nasty succession conflict, which Sacrus would view as an unnecessary . . . distraction, right now. Besides," Sarto shrugged. "There are few moments in a man's life when he has the opportunity to make a choice on his own. I simply did not want to shoot you."

"And why tell me this now?"

His mouth didn't change from its accustomed frown, but the lines around Sarto's eyes might have crinkled a little bit—an almost smile.

"It will be easy for me to tell my masters that the pistol was taken from me at your door," he said. "Without an opportunity to acquire or silence you, letting you win was the expedient option. My masters know that." He turned away, then looked back with a scowl. "I hope you won't give me reason to regret my decision."

"Surely not. And my apologies for inconveniencing you."

He laughed at the edge in her voice.

"You may think you're free," he said as the crowd parted to let him through, "but Sacrus still owns you. Never forget that."

Venera kept her smile bright, but his parting words worried at her for the rest of the evening.

11

Muscles aching, Venera swung down from the saddle of her horse. It was two weeks since the confirmation and she had lost no time in establishing her rule over Buridan—which, she had decided, had to include becoming a master rider.

She'd knocked down two walls and walled up the ends of one of the high-ceilinged cellar corridors, forming one long narrow room where her steed could trot. There were stalls at one end of this, and two workmen were industriously scattering straw and sand over the plating. "Deeper," Venera told them. "We need several inches of it everywhere."

"Yes, ma'am." The men seemed unusually enthusiastic and focused on their task. Maybe they had heard that the new foals were to arrive later today. Probably it was just being in proximity with the one horse now residing here. Venera hadn't yet met anyone who didn't share that strange, apparently ancient love for horses that seemed inbuilt to humans.

Venera herself wasn't immune to it. She patted Domenico and walked down the length of the long room, trailing one hand along the low fence that bisected it lengthwise. Her horsemaster stood at the far end, a clipboard clutched in his hand; he was arguing quietly with someone. "Is everything all right, gentlemen?" Venera asked.

The other man turned, lamplight slanting across his gnomish features, and Venera said, "Oh!" before she could stop herself.

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Samson Odess screwed his fishlike face up into a smile and practically lunged over to shake her hand.

"I'm honored to meet you, Lady Thrace-Guiles!" His eyes betrayed no recognition, and Venera realized that she was standing in heavy shadow. "Liris is honored to offer you some land to stable your horses. You see, we're diversifying and—"

She grinned weakly. It was too soon for this! She had hoped that the men and women of Liris would be consumed by their own internal matters, at least long enough for her new identity to become fixed. If Odess recognized her the news would be bound to percolate through the Fair. She didn't believe in its vaunted secrecy any more than she believed that good always triumphed.

She let go of Odess's hand before he could get entirely into his sales pitch, and turned away. "Charmed, I'm sure. Flance! Can you deal with this?"

"Oh, but Master Flance was unable to resolve one little matter," said the horse master, stepping around Odess.

"Deal with it!" she snarled. She glimpsed a startled look in Odess's eye before she swept by the two men and into the outer hallway.

Well, *that* had been an unexpected surge of adrenalin! She laughed at herself as she strode quickly through the vaulted, whitewashed spaces. In the half-minute it took her to slow down to a stroll, Venera took several turns and ended up in an area of the cellars she didn't know.

Someone cleared his or her throat. Venera turned to find a man in servant's livery approaching. He looked only vaguely familiar but that was hardly surprising considering the number of people she'd hired recently.

"Ma'am, this area hasn't been cleaned up yet. Are you looking for something in particular?"

"No. I'm lost. Where did you just come from?"

"This way." The man walked back the way they had both come. He was right about the state of the cellars; this passage hadn't been reconstructed and was only minimally cleaned. Black portraits still hung on the walls, here and there an eye glaring out from behind centuries of dust and soot. The lanterns were widely spaced and a few men visible down a side way were reduced to silhouettes, their backdrop some bright distant doors.

"Down this way." Her guide indicated a black stairwell Venera hadn't seen before. Narrow and unlit, it plummeted steeply down.

Venera stopped. "What the—" Then she saw the pistol in his hand.

"Move," grated the man. "Now."

She almost called his bluff. One of those quick sidesteps Chaison had taught her, then a foot sweep . . . he would be on the floor before he knew it. But she hesitated just long enough for him to step out of reach. Caught unprepared for once, Venera stumbled into the blackness with him behind her.

"You're in a lot of trouble," she said.

"We're not afraid of the authorities," said her kidnaper contemptuously.

"I'm not talking about the authorities, I'm talking about *me*." The stairs had ended on a narrow shelf above an indistinct, dark body of water. It was dank and cold down here; looking left and right she saw that she was standing on the edge of large tank—a cistern, no doubt.

"We've been watching you," said the shadowy figure behind her. "I assure you we know what you're capable of." The pistol was in her back again and he was pushing her hard enough that she had trouble keeping her feet. Angrily she hurried ahead and emerged onto the iron plating next to the water. "I didn't know I had this," she commented as she turned right, toward the source of the light.

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"It's not yours, this is part of the municipal water supply," said a half-familiar voice up ahead.

She eyed the black depths. Jump in? There might be a culvert she could swim through, the way heroes did in romance novels. Those heroes never drowned in the dark, though, and besides even if she made it out of here her appearance, soaking wet, in the streets of the city was bound to cause a scandal. She did not need that right now.

There was an open area at the far end of the tank. The same tables and crates she'd seen in the wine cellar were set up here, and the same young revolutionaries were sitting on them. Standing next to a lantern-lit desk was the youth with straight black hair and oval eyes. He was dressed in the long coat and tails she'd seen fashionable men wearing on the streets of the wheel; with his arms crossed the coat belled out enough for her to see the two pistols holstered at his waist. She was suddenly reminded of Garth's apparel, which was like a down-at-heel version of the same costume.

"What's the meaning of this?" she snapped, even as she counted people and exits (there was one of the latter, a closed iron door). "You're not being very neighborly," she added more softly.

"Sit her down and tie her up," said the black-haired youth. He had a high tenor voice, not unmanly but refined, his words very precise. His eyes were gray and cold.

"Yes, Bryce." The man who'd led her here sat her down on a stout wooden chair next to the table, and pulling her arms back proceeded to tie a clumsy knot around her wrists.

Venera craned her neck to look back. "You obviously don't do this much," she said. Then, spearing this Bryce fellow with a sharp eye, she added, "Kidnapping is precision work. You people don't strike me as being organized enough to pull it off."

Bryce's eyebrows shot up, that same look of surprise he'd shown in the cellar. "If you'd been following our escapades you'd know what we're capable of."

"Bombing innocent crowds, yes," she said acidly. "Hero's work, that."

He shrugged, but looked uncomfortable. "That one was meant for the council members," he admitted. "It fell back and killed the man who threw it. That *was* a soldier's death."

She nodded. "Like most soldiers' deaths, painfully unnecessary. What do you want?"

Bryce spun another chair around and sat down in it, folding his arms over its back. "We intend to bring down the great nations," he said simply.

Venera considered how to reply. After a moment she said, "How can kidnapping me get you any closer to doing that? I'm an outsider, I'm sure nobody cares much whether I live or die. And nobody will ransom me."

"True," he agreed with a shrug. "But if you go missing, you'll soon be declared a fraud and the title to Buridan will go up for grabs. It'll be a free-for-all, and we intend to make sure that it starts a civil war."

As plans went, it struck Venera as eminently practical—but this was not a good time to be smiling and nodding.

She thought for a while. All she could hear was the slow *drip drip* of water from rusted ceiling pipes; doubtless no one would hear any cries for help. "I suppose you've been following my story," she said eventually. "Do you believe that I'm Amandera Thrace-Guiles, heir of Buridan?"

He waved a hand negligently. "Couldn't care less. Actually, I think you are an imposter, but why does it matter? You'll soon be out of the picture."

"But what if I *am* an imposter?" She watched his face closely as she spoke.

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"Where do you suppose I came from?"

Now he looked puzzled. "Here . . . but your accent is foreign. Are you from outside Spyre?"

She nodded. "Outside Spyre, and consequently I have no loyalty for any of the factions here. But I do have one thing—I've come into a great deal of money and influence, using my own wits."

He leaned back, laughing. "So what are you saying?" he asked. "That you're a sympathizer? More like an opportunist; so why should I have anything but contempt for that?"

"Because this power . . . is only a means to an end," she said. "I'm not interested in who governs or even who ends up with the money I've gained. I have my own agenda."

He snorted. "How vague and intriguing. Well, I'm sure I can't help you with this ill-defined 'agenda.' We're only interested in people who *believe*. People who know that there's another way to govern than the tyrannies we have here. I'm talking about emergent government, which you as a barbarian have probably never even heard of."

"Emergent?" Now it was Venera's turn to be startled. "That's just a myth. Government emerging spontaneously as a property of people's interactions . . . it doesn't work."

"Oh, but it does." He fished inside his jacket and came out with a small, heavily worn black book. "This is the proof. And the key to bringing it back." He held the book up for her to see; with her limited mobility, Venera could just make out the title: *Rights Currencies, 29th Edition*.

"It's the manual," he said. "The original manual, taken from the secret libraries of one of the great nations. This book explains how currency-based emergent government works, and provides an example." He opened the book and withdrew several tightly folded bills. These he unfolded on the table where she could see them. "People have always had codes of conduct," said Bryce as he stared lovingly at the money, "but they were originally put together hit or miss, with anecdotal evidence to back them up, and using armies and policemen to enforce them. This is a system based on the human habit of buying and selling—only you can't use this money to buy *things*. Each bill stands for a particular *right*."

She leaned over to see. One pink rectangle had the word JUDGEMENT printed on it above two columns of tiny words. "The text shows which other bills you can trade this one for," said Bryce helpfully. "On the flip side is a description of what you can do if you've got it. This one lets you try court cases if you've also got some other types of bill, but you have to trade this one to judge a trial. The idea is you can only sell it to someone who doesn't have the correct combination to judge and hopefully whoever they sell it to sells it back to you. So the system's not static, it has to be sustained through continual transactions."

She looked at another bill. It said GET OUT OF JAIL FREE. The book Bryce was holding, if it was genuine, was priceless. People had been looking for these lost principles for longer than they'd been trying to find the last key to Candesce. Venera had never believed they really existed.

Pointedly, she shrugged. "So?"

The young revolutionary snatched up the bills. "Currencies like this can't just be *made*," he proclaimed, exhibiting a certain youthful zeal that she would have found endearing in other circumstances. "The rights, the classifications, number of denominations, who you can trade to—all of those details have to be calculated with the use of massive simulations of whole human societies. Simulate the society in a computing machine, and test different interactions . . . then compile a list of ratios and relations between the bills.

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Put them in circulation, and an ordered society emerges from the transactions—without institutions getting in the way. Simple."

"Right," said Venera, "And I'm betting that this book wasn't designed for a world like Virga, was it? Isn't this a set of rules for people who live on a flat-world—a 'planet'? The legend says that's why the emergent systems were lost—because their rules didn't apply here."

"Not the old ratios, it's true," he admitted. "But the core bills . . . they're sound. You can at least use them to minimize your institutions even if you can't eliminate them completely. We intend to prove it, starting here."

"Well, that's very ambitious." Venera suddenly noticed the way he was looking at her. She was tied with her arms back and her breasts thrust at this young man and he was obviously enjoying her predicament. For the first time since being brought down here, she found herself genuinely off balance.

She struggled to regain her line of thought. "Anyway, this is all beside the point. Which is, that I am in a greater position to help you as a free woman than as a social pariah—or dead. After all, this civil war of yours probably won't happen. As you say, the great nations have too big a stake in stability. And if it doesn't happen, then what? It's back to the drawing board, minus one hideout for you. Back to bombing and other ineffectual terrorist tactics."

Bryce closed the book and restored it to his jacket. "What of it? We've already lost this place. If the war doesn't happen there's no downside."

"But consider what you could do if you had an ally—a patroness—with wealth and resources, and more experience than you in covert activities?" She looked him straight in the eye. "I've killed a number of men in my time. I've built and run my own spy organization—no, I'm not Amandera Thrace-Guiles. I'm someone infinitely more capable than a mere heir to a backwards nation on this backwards little wheel. And with power, and wealth, and influence . . . I can help you."

"No deal." He stood up and gestured to the others to follow him as he walked to the metal door.

"A printing press!" she called after him. He looked back, puzzled. "In order for that money to work," she continued, "don't you need to mint thousands of copies of the bills and put them into circulation? It has to be used by everybody to work, right? So where's your printing press?"

He glanced at his people. "It'll happen."

"Oh? What if I offered you your own mint—delivery of the presses in a month—as well as a solid budget to print your money?"

Bryce appeared to think about it, then reached for the door handle.

"And what if you had an impregnable place to house the press?" she called, frantically reaching for the only other thing she could think to offer. *"What if Buridan tower was yours?"*

One of his lieutenants put a hand on Bryce's arm. He glared at the man, then made a sour face and turned. "Why on Spyre would we trust you to keep your end of the bargain?"

"The tower contains proof that I'm an imposter," she said quickly. "The council is going to want to visit it, I'm sure of it—but how can I clean it up and make it presentable? None of my new servants could be trusted with the secret. But you could—and you could take photographs, do what you need to do to assemble proof that I'm not the heir. So you'll have that to hold over me. You'll have the tower, you'll have money, and as much influence as I can spare for you."

He was thinking about it, she could tell—and the others were impressed as well. "Best of all," she added before he

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could change his mind, "if my deception is ultimately revealed, you may get your civil war anyway. What could be better?"

Bryce walked slowly back to her. "Again I say, why should we trust you? If there's proof as you say in Buridan tower . . . if you'd even let us get there before the police descended on us . . . Too many ifs, Ms. Thrace-Guiles."

"I'll draft you a note right now," she said. "Made out to the night watch at the elevators, to let your people ride the elevator down to Buridan Tower. You can do it right now, and release me after you're sure I'm right."

"And be trapped there when your charade is exposed?"

That was just too much for Venera. "Then forget it, you bastard!" she yelled at him. "Go on, get out! I'm sure you're far too busy playing the romantic revolutionary leader. Go and sacrifice the lives of a few more of your friends to convince the rest of them that you're actually doing something. Oh, and blow up a few women and babies for good measure, I'm sure that'll make you feel better—or start your damned war and kill ten thousand innocents, I don't care! Just get out of my sight!"

Bryce's face darkened with anger, but he didn't move. Finally he stalked over and scowled at her. Venera glared back.

"Bring this woman some paper," he said. "You'll write that note," he said in a low voice, "and we'll see what we can find in Buridan Tower."

The streets had not changed since his childhood. Garth Diamandis strode familiar ways, but after such a long absence it was as if he saw them with new eyes. His town-wheel, officially known as Wheel 3, had been called Hammerlong for centuries. Its riveted iron diameter spanned nearly a mile, and the inside surface on which the buildings were set was nearly half that wide. It had spun for five hundred years. In that time, the layout of Hammerlong's gargoyled buildings had been rearranged—or not where they accommodated stubborn holdouts—dozens of times. New edifices had hiked their buttresses over the shoulders of older ones as the population grew, then shrank, then grew again. The wheel had been fixed, reinforced, rejigged, and thrown out of whack by weight imbalances so often that its constant creaking and groaning was like background music to the citizens who lived there. The smell of rust permeated everything.

With finite space, the citizens of the wheel had jammed new buildings in between existing ones; corkscrewed them inward and outward from the rim; overgrown what was original with the new. Streamlined towers hung like knife blades below the rim, their bottom-most floors straining under nearly two gravities while the stacked apartments overhead converged to shadow the streets and a second layer of avenues, then a third, were built up where weight diminished. Yin-yang stairs, elevator cables, ancient rust-dribbling spokes, and leaking pipes all knotted together at the smoke-wreathed axis. Ships and shuttles clustered there like grazing flies.

Hammerlong seemed designed for skulking and the population did just that. Most were citizens of nations based on Greater Spyre, after all, so they brought the paranoia of that realm with them to the city. Those born and raised in Hammerlong and the other wheels were more open, but they formed a separate class and had fewer rights in their own towns. Left to their own devices, they cultivated a second economy and culture in the alleys, air-shafts and crawlspaces of the layered city.

Garth was on a third-level street when the full force of nostalgia hit him. He had to stop, his imagination

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filling in gaps in the crowds that scurried to and fro like so many black-clad ants. He saw the young dandies of his youth, swaggering and hipshot to display their pistols; the ingenues leaning on their balconies high above, their attention apparently elsewhere. He had walked or run or fled down these ways dozens of times.

Some of his old compatriots were dead, he knew, some had moved on to build prosperous families and deny their youths. Others . . . the prisons were still full, one of Venera Fanning's new carpenters had told him this morning. And, if one knew where to look, and how to read . . . there, yes he saw a thin scrawl of graffiti on a wall ten feet beyond the parapet. Made with chalk, it was barely visible unless you knew to look for it. *Repeal Edict 1*, said the spiky letters.

Garth smiled. Ah, the naivete of youth! Edict 1 had been passed so long ago that most citizens of Spyre didn't even know it existed, nor would they have understood its significance if it were described to them. The hotheaded youth of Spyre were still political, it seemed, and still as incompetent at promoting their politics as in his day. Witness that appalling bomb attack yesterday.

The memory chased all sentimentality out of Garth's mind. His mouth set in a stoic frown, he continued on down the street, digging his hands deep in his coat pockets and avoiding the glances of the few women who frequented the walkway. His aching feet carried him to stairs and more stairs, and his knees and hips began to protest at the labor. The last time he'd gone this way he'd been able to run all the way up.

Hundreds of feet above the official street level of Hammerlong, a bridge had been thrown between two buildings back in the carefree Reconstructionist period. Culture and art had flourished here before the time of the preservationists, even before the insular paranoia that had swallowed all the great nations.

The bridge was two stories tall and faced with leaded glass windows that caught the light of Candesce. It wasn't used by occupants of either tower; the forges of one had little use for the paper-making enterprise in the other. For decades, the lofting, sunlit spaces of the bridge had been used by bohemian artists—and the agitators and revolutionaries who loved them.

Garth's heart was pounding as he took the last few steps up a wrought-iron fire escape at the center of the span. He paused to catch his breath next to the wrought-iron curlicues of the door, and listened to the scratchy gramophone music that emanated from it. Then he rapped on the door.

The gramophone stopped. He heard scrambling noises, muffled voices. Then the door cracked open an inch. "Yes?" a man said belligerently.

"Sorry to disturb you," Garth said with a broad smile. "I'm looking for someone."

"Well, they're not here." The door started to close.

Garth laughed richly. "I'm not with the secret police, young pup. I used to live here."

The door hesitated. "I painted this iron about . . . oh, twenty years ago," Garth said, tracing his finger along the curves of metal. "It was rusting out, just like the one in the back bathroom. Do the pipes still knock when you run the water?"

"What do you want?" The voice held a little less harshness.

Garth withdrew his hand from the remembered metal. With difficulty he brought his attention back to the present. "I know she doesn't live here now," he said. "Too much time has passed. But I had to start somewhere and this was the last place we were together. I don't suppose you know . . . any of the former occupants of the

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place?"

"Just a minute." The door closed, then opened again, widely this time. "Come in." Garth stepped into the sunlit space and was overwhelmed by memory.

The factory planks paving the floor had proven perfect for dancing. He remembered stepping into and out of that parallelogram of sunlight—though there had been a table next to it and he'd banged his hip—while she sang along with the gramophone. That same gramophone sat on a windowsill now, guarded by twin potted orange trees. A mobile of candles and wire turned slowly in the dusty sunlight, entangling his view of the loft behind it. Where he'd slept, and made love, and played his dulcimer for years . . .

"Who are you after?" A young woman with cropped black hair stood before him. She wore a man's clothing and held a tattoo needle loosely in one hand. Another woman sat at the table behind her, shoulder bared and bleeding.

Garth took a deep breath and committed the name to speech for the first time in twenty years. "Her name is Selene. Selene Diamandis . . ." ■

To be continued.

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THE REFERENCE LIBRARY Tom Easton

Eifelheim, Michael Flynn, Tor, $25.95, 320 pp. (ISBN: 0-765-30096-6).

Soldier of Sidon, Gene Wolfe, Tor, $24.95, 320 pp. (ISBN: 0-765-31664-1).

Deep Storm, Lincoln Child, Doubleday, $24.95, 307 pp. (ISBN: 978-0-385-51550-4).

The Jennifer Morgue, Charles Stross, Golden Gryphon Press, $25.95, 313 pp. (ISBN: 1-930846-45-2).

Brass Man, Neal Asher, Tor, $14.95, 485 pp. (ISBN: 0-765-31731-1).

Outbound, Jack McDevitt, ISFiC Press, $30.00, 352 pp. (ISBN: 0-9759156-3-0).

This Is My Funniest, Mike Resnick, ed., BenBella Books, $14.95, 427 pp. (ISBN: 978-1-932100-95-2).

Eifelheim may be Michael Flynn's best yet. By any measure, it's an extraordinary piece of work, well worth awards, readers, and royalties galore.

You may recall the *Analog* novella of the same name (November 1986) from which the novel grew, but I will pretend you don't as I discuss the book here. The starting point is the notion that historical records are incomplete, fragmentary, and scattered, and some very science-fictionally interesting things may have happened in the past. So meet Tom Schwoerin, a cliologist who studies history in terms of such things as topology. He has found a blank spot in the Black Forest settlement pattern, a town that was there before the Black Death is no longer there, even though other died-out towns were promptly resettled. It is as if the location had become taboo, and perhaps its new name of Eifelheim (which he learns was Oberhochtwald originally, and then for a time Teufelheim) says something about the reason why.

His partner, Sharon Nagy, is a physicist studying brane theory and the structure of space-time, and the Astute Reader immediately intuits that the two topics will become closely connected. Nor does Flynn let that reader wait for long, for the tale alternates times and locales, with prolonged visits to Oberhochtwald, where the pastor, Dietrich, is an intelligent and rational man who is apparently in seclusion from the centers of European culture, politics, and Inquisition. When thunder, a wind that topples trees, and lightning that sets houses afire are accompanied by strange phenomena that Dietrich recognizes as kin to the sparks generated by rubbing fur on amber and promptly names *electronikos*, and strangely shaped beings show up in the woods, the shape of the tale is clear. An alien ship has crashed, and now the castaways must somehow survive. But the medieval mind has no room for aliens. It knows angels and demons, and of course, no one suspects for a moment that the aliens are angels. It takes Dietrich awhile to get his flock

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to see that the Krenken are people like themselves (at least in some ways), and if he does not succeed in all cases, he shows that he himself, at least, has a remarkable mind. As the tale develops, he even proves able to put modern concepts of physics and electronics into terms that fit what he knows, a feat that also gives Flynn something to brag on (the fitting of modern to old is sometimes strained but is on the whole impressive). Yet Oberhochtwald has neighbors, and as the word of the Krenken leaks out, as it inevitably must, concern grows that the town will become known for harboring demons, Dietrich will be summoned to account and his past will be discovered, and the Krenken themselves will be destroyed before . . . Before what? Some of the Krenken are frantically struggling to repair their ship's engines, using what they can of medieval technology. All the Krenken are facing a nutritional deficit. And the Black Death is spreading across Europe, drawing ever nearer to the Black Forest.

Meanwhile Tom is discovering, with the aid of Judy Cao, a librarian and narrative historian, numerous clues to what happened at and to Oberhochtwald. (At one point, he even muses that he has enough to write the story.) One of those clues is a document with an elaborate illumination. At the same time, Sharon's theorizing is advancing apace, until she can begin to think in terms of circuitry.

In the end, the pieces come together in a rush, marred only by a certain cryptic painting that struck me as an unneeded detail. The painting is hidden away, but it is known to some and it is so strange that if anyone at all knows of it, it must surely be announced to the world. If it were, Tom would surely have known of it much sooner and the path through the mystery would have been more direct. Yet this is only a small thing that in no way detracts from the judgment with which I began this review.

Read it. You'll love it.

* * *

Gene Wolfe's *Soldier of the Mist* (reviewed here in May 1987) and *Soldier of Arete* (reviewed here in August 1990) introduced us to Latro, a mercenary of classical Greece who, because of a head injury, must live his life one day at a time. When he sleeps, he forgets the previous day, with only a few minor, intriguing exceptions. Too, he can see such supernatural beings as the gods, talk with them, and do their bidding. Naturally enough, he yearns for the home of his childhood, for peace, for an intact mind. But he is perhaps a god himself, forfeiting the memory of his origins in order to work out some Earthly plan.

When **Soldier of Sidon** opens, Latro is on his way to Riverland (Egypt) to learn what has happened to him. He is with an old friend, Muslak, who takes him to healers and explains to the readers how Latro left his home and wife to go with him. Now he has a "river wife" from the temple of Hathor. The healers can't help, of course, and when Muslak is summoned to sail up the Nile to see the satrap, Latros is embarked on a new adventure. The mission is to reconnoiter the upper reaches of the Nile, above the cataracts, and report back. Along the way, Latros discovers that he still sees gods that no one else can glimpse, as well as strange beasts and the wax bride of the warlock. They all seem to have missions for him. The wax bride wants to be his, and the gods, among other things, want him to visit the temple beyond the last temple. But first he must choose to go in search of a noble youth sent to discover the truth of the rumors about Nubian gold mines, and now missing. Now things become disjointed, for he is separated from his scroll and his memories for a time. But he gets them back, with a little help from his friends, though not his mighty sword, Falcata, the recovery of which must await another volume.

Wolfe tells the "Soldier" tales from a

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very limited viewpoint, that of what a man of impaired memory manages to record of his days and thoughts. If Latro mislays or is separated by events from his scroll, if he forgets to write, if the scroll is damaged, days and events, forces and motivations, are lost to us forever. His life is a series of vignettes. If there is any continuity, any theme, it is whatever of personality and destiny remain without memory. It is, in fact, his friends who constantly reintroduce themselves and each other and rededicate themselves to him. In the first two books, Wolfe examined memory as internal, which can vanish as the morning dew, and memory as record, which can survive the flesh but can still be lost or forgotten and can also suffer gaps. Now his theme is memory as web of social relationships, which can also survive the flesh but may be less vulnerable to loss, at least in the short term. What is left? What kind of memory survives the flesh and is even less vulnerable to loss, even in the long term? What but our genes, as long as we breed. Perhaps that will be the focus of the next volume.

Lincoln Child is a thriller writer known for *Death March* and, with Douglas Preston, *The Book of the Dead* and others. Given titles like those, when **Deep Storm** opens with a prologue set on the Storm King drilling rig where strange things that make folks go "Oh, my God . . ." are happening deep in the well, the reader expects to find out that the drill has broken through into Hell and a gusher of the damned is about to rise.

Well, it isn't that. In fact, it's much worse, though when Doc Peter Crane is recruited for a top-secret assignment, it seems just weird. Atlantis? At the bottom of the North Atlantic? C'mon now! The people feeding him the line seem to believe it, and even though he is being recruited for his skills at medical detection, he shows a sore lack of critical thinking. Or perhaps it is just that he is focused on medical detection, for he is being hired to diagnose bizarre medical conditions that have no clear cause or even common factor, other than the residence of the patients—on the sea bottom, where the Defense Department has spent billions to install a nuclear-powered research facility the size of an office building. The whole place is so top-secret that no one is allowed to leave, no matter how sick they get, and the bottom levels are surrounded by security barriers that even a doctor has trouble getting through.

What's going on? It doesn't take long for Crane to learn that all this money and secrecy is not being devoted to uncovering Atlantis. There is something very strange under the seabed, down in the mantle actually, and excavation is proceeding apace in search of what just might be wondrous technological gizmos, origin unknown, spurred on by the discovery of smallish gadgets that emit multicolored light and other radiation.

But there is sabotage. The security chief is a goon from Central Casting who is not above committing a bit of sabotage himself to keep Crane from discovering any answers that might interfere with the tunneling into the depths. But Crane is a competent fellow, able to find allies who can decrypt hidden messages, reconstruct trashed hard drives, and finally . . .

If I say too much, I'll spoil it for you, and though the story has its problems, it's good enough not to spoil. If you need more clues, let me refer you to Greg Benford's *Deep Time* (reviewed here in September 1999), which deals with the difficulty of marking dangerous sites in ways that will be meaningful to our descendants a million years hence.

In *The Atrocity Archives* (reviewed here in June 2006), Stross presumed that mathematics, topology, physics, and computers all had the power to open portals and let the eldritch horrors of

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Lovecraft, *et al.*, through. Naturally, there are government agencies whose business it is to prevent disaster, either by stopping meddlers (sometimes by recruiting them) or by cleaning up the mess after the meddling. One of their employees is Bob Howard, once a graduate student whose work became meddling, now a computer geek whose usual job at the Laundry was keeping the computers running smoothly until they needed him for something more active.

Since *Archives* was great fun, I was happy to see **The Jennifer Morgue** in the mail. It's the sequel, and this time Stross has chosen to send up the greatest of all British spies—James Bond himself. The tale begins with a look back in time, to when the drilling ship *Glomar Explorer* was trying to raise a Russian submarine but was stopped by the tentacular denizens of the abyss who objected to the intrusion on their territory in defiance of the treaty. Before long, Bob Howard is discovering he has been teamed with the deadly Ramona Random, human-Deep Blue hybrid, and is expected to infiltrate the schemes of Ellis Billington, who operates from a yacht that used to be a battleship and is planning to raise a device belonging to ancient chthonic (magma-dwelling) enemies of the Deep Blue folk. Remember that the Earth has more seabed than dry land, and underlying both is much, much more space for the chthonics. Humans are a footnote. If the other guys just get peeved, we are a smear on the pavement. The Laundry *really* wants to keep that from happening.

But Billington holds all the cards. He even has a spell generator that creates a Bondian eigenplot (like an eigenvector, an eigenplot is invariant under transformation). There is a villain, a scheme, a Bondian hero, a Good Bond Babe, and a Bad Bond Babe, and the more everyone acts their parts, the stronger the spell grows. The trouble is that Bob is pretty clueless, and everyone seems to be trying very hard to keep him clueless. Is he supposed to be the Bond? He fumbles his way through the obligatory baccarat scene, but it's not long before he's safely locked up. So is Ramona. Or is he one of the Babes? And where's Mo, his girlfriend? Well, she has just exited a Laundry training course and found out what is happening. She's pissed, she has her magic violin, and she's on her way to help.

It gets complicated, but it's all a lot of fun. I highly recommend it, and it doesn't hurt a bit that Stross tosses in a short story, "Pimpf," in which Bob hunts for meddlers in the virtual worlds of computer games, and an essay on "The Golden Age of Spying," in which he links the Bond myth to the Cold War era, in which international espionage was very active and people badly needed a feel-good version of current events and apocalyptic anxieties. Today, he says, espionage uses fewer secret agents and more electrons, and though we dodged Armageddon, SPECTRE actually won.

That makes a good line, but I'm not sure he's right. We certainly have plenty of corrupt captains of industry, but we also seem to be bringing many of them (think of Enron) down.

Neal Asher's Polity universe is a realm which humans share with the artificial intelligences they have spawned, some of which are so powerful that they rule. Humans themselves are protean, able to move from body to body, change gender, move into virtualities, and even become AIs themselves. Boundaries are fluid and the norms to which we are accustomed today no longer exist.

Nor are we alone in the universe. Star-spanning civilizations have arisen and vanished, perhaps because they ran afoul of the self-reproducing Jain technology, which infiltrates both flesh and silicon, gives an illusion of control, and bends all to its purposes. There is also Dragon, a creature—if that is even the right word—consisting of four kilometer-wide spheres. When attacked, it

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broke apart. One sphere crashed and gave rise to the reptiloid Dracomen. Another went to ground on a frontier world, Cull.

And then there's the **Brass Man**, Mr. Crane, a Golem (robot) who instead of serving and protecting the Polity as designed has been stolen and subverted by uploading the mind of a mass murderer. His mind—and brain—wound up fractured into several pieces, and in an earlier novel he was defeated, dismembered, and buried. At the time, Asher's heroes thought the threat of the Jain technology was buried too—or at least quarantined—but as *Brass Man* opens, it is reemerging, crawling from a wrecked ship to seize a prospector. Worse yet, the villain Skellor, who thinks he has mastered the secrets of the Jain technology, at least enough to make it part of his body and will, is digging up Mr. Crane and reassembling him to assist in Skellor's hunt for Dragon. Soon Ian Cormac, an agent of Earth Central Security who does not understand his own powers, is also on Dragon's trail, as, on Cull, is a thoroughly retro and rather Vancian Knight of Rondure who, mounted on a strange beast called a sand-hog, seeks a dragon to spit on his lance.

The strands perforce converge in an action-packed climax that leaves the world of Cull reeling, the reader a bit breathless, and enough loose ends for at least one sequel. Yet the reader is not satisfied. There are so many flashbacks to fill in past events that the plot line is not always easy to follow. There are also a great many characters, so many indeed that none are developed past the point of comic strip caricature. The reader has a pretty good idea who the good guys are—Cormac's one of them, and so seem all fully human beings. Anything tainted by Jain is evil. But whose side are the AIs on? Some become enemies, but the rest have their own rather cryptic agendas. And as for Dragon, it seems relatively benign and more than a little wise, but it is also cool in its emotional tone, perhaps more neutral than we would like to see. The overall effect is that the tale is marred by a distancing of the reader.

If you're an Asher fan, this may not put you off. If you're not, I don't think this book will make you one.

Sixteen stories and eight essays by Jack McDevitt fill the pages of **Outbound**, and if in his introduction Barry Malzberg can lament that his favorite McDevitt story ("Time Travelers Never Die") isn't here, neither is "Cryptic" or "The Jersey Rifle." But there are plenty more, all of them well worth your attention.

But that's Jack for you. Not only is he a marvelously nice guy (says Michael Bishop in the celebratory afterword), he is always well worth your attention. If you see a new book with his name on the cover, grab it. You're not likely to be disappointed.

At least with the fiction. He is a limpid and original writer not given to modernistically baroque futures but rather to bringing classic themes of exploration and discovery into the present. The essays, however, show a tendency to repeat himself as if he has only so many things to say about himself and his work and he would rather put his energy into the fiction than into saying the same old things in fresh ways. He is hardly alone in this, though some writers do seem to put as much (or more) energy into talking about themselves as into writing, but here it jumped out at me.

There is a persistent rumor that SF editors don't buy funny SF stories. Granted, funny stories are hard to write, partly because what strikes the writer as funny may not seem so to anyone else and partly because balance and timing are more crucial to humor than to any other kind of SF. The latter may make humor more challenging to the writer than other types of fiction, which explains why almost every writer tries his

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or her hand at it, at least once. Enough are successful to explain why there are so many gems of SF humor on our shelves.

There are? But editors don't buy the stuff, do they? They do? Oh, yeah, he called it a rumor, didn't he, and rumors live in the garret upstairs and have very little to do with what goes on in the front parlor.

A bit too feeble for you? You'll have better luck with **This Is My Funniest**. Mike Resnick asked Harry Harrison, William Tenn, David Gerrold, David Brin, Jack McDevitt, Spider Robinson, Robert Silverberg, Howard Waldrop, Esther Friesner, Michael Swanwick, Joe Haldeman, Harry Turtledove, Connie Willis, the late Robert Sheckley, and fifteen more, including Jane Yolen, whose "Dick W. and His Pussy, or Tess and Her Adequate Dick" needs no more than its title to make you grin.

So. Grins and smiles, chuckles and guffaws. The perfect book for an airplane trip, or a guest room, or a gift, or just for fun. Enjoy it! ■

IN TIMES TO COME

Our May 2007 issue features stories of all shapes and sizes, including "Damned If You Do . . . ," a lively, imaginative, and disconcerting adventure story by Lee Goodloe; a unique experiment in making the parts of a society work together by Richard A. Lovett; and a new tale by a writer too long away, Brian Plante. One of the short stories, Carl Frederick's "A New Level of Misunderstanding," may quite rightly remind you of an earlier (and decidedly amusing) story of alien contact. It also pairs quite aptly with our fact article, Henry Honken's "I Couldn't Read You, E.T.," about some of the real (and far from trivial) problems we might face in trying to communicate with real aliens.

Last but far from least, we'll have the third and penultimate part of Karl Schroeder's novel *Queen of Candesce*.

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BRASS TACKS

Dear Dr. Schmidt,

I just finished reading your (November, 2006) editorial, "The Tyranny of Physical Law." Thanks for writing it!

Your example of pulling on an electric cord is very familiar, but I'm sure that we all know of cases where the cord was only slightly stuck, and a sharp tug released it. Too bad that what one learns from such a case isn't really applicable more generally.

By the way, I fully intend to steal some of your "you already know physics, you just don't know the formal language" for introductory physics lectures. A bit of confidence building is sometimes helpful to overcome student anxiety, and much of freshman mechanics is simply refining and systematizing the physical intuition one already has.

Your editorial did get me thinking (that's the point, right?) about problem-solving in general. Perhaps you've written about the particular point I'll raise, but in reading *Analog* since the mid '70s I don't recall it (insert "memory is the first to go" joke here).

The difficulty I'm referring to is in trying to deal with an "intermittent" problem or fault. That is, a problem that only shows up occasionally, and where it's unclear what is the real cause behind that problem. One doesn't have to use quantum mechanics to get such seemingly random occurrences of an "intermittent," just a large number of possible causes, with complicated and unclear interconnections between them.

There are plenty of technological examples, with consumer electronics, automobiles, and computers being especially fertile grounds for frustrating intermittent faults.

In my own work (experimental particle physics) the large and complicated detectors that I design, build, and work with are certainly not immune to intermittent problems in spite of the enormous resources (money, equipment, and brainpower) that are devoted to making them work. But at least we do most of our own bug chasing and fixing. For consumers, intermittent faults are particularly frustrating when having to deal with customer support reps and warranty service. The problems inevitably disappear when you most need them to show themselves to get some help. This must be a corollary of Murphy's Law: "When you need something to go wrong, it won't."

The basic difficulty is this: if you don't know what *caused* a problem, how do know when it is *fixed?* That's in addition to the difficulty that without a known cause, any fixes that are attempted are unlikely to work. An intermittent fault, by it's very nature, isn't regular or predictable, so if it occurs right after a fix is attempted, that will tell you that the fix didn't work, but otherwise you have to wait a long, *long* time before one has some confidence that the problem really was fixed.

In addition, it seems to be something in human (or group?) psychology that will assign blame on some particular cause, in spite of the lack of definitive evidence. An example of this is blaming "power glitches" for computer problems. It's easy to blame, and unless one

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has (expensive!) power-line monitoring and recording instruments, it's difficult to eliminate such glitches as a cause. It's much easier to spend some money on power filters, note that the problem has gone away (has it?), and be happy until the next intermittent fault occurs. This logic sells lots of power-filters, but it's not clear that it really solves many problems.

There are implications beyond technology for such intermittent fault problems. Just look at the rate of major terrorist attacks in the US, and the measures taken to prevent them. How do you know if the measures work? You can say "Well, there hasn't been an attack," but how long do we have to go without an attack to prove it? Five years? Ten? I could just as easily point to my lucky pen that protects me from rhino attacks: no attacks so far—it must be working!

To really solve intermittent faults in technology, one first has to find a way to trigger the fault. Repeatability is the key, as it is for much of science. It doesn't require knowing all the mechanisms by which the fault occurs, at least not initially, but having a "if you do *this,* then you get *that"* allows one to test possible fixes to find out if they really work or not. So the first step in diagnosing a piece of equipment is to really break it well. That's also the first step in getting warranty repair. Although they sure aren't going to tell you to "break it first, then give us a call," that's often what you have to do.

I hope I haven't tried your patience with rambling on too long. As always, I greatly enjoy the entertaining and thought-provoking material you publish, whether it's an editorial, fact article, or fiction. Keep up the good work!

Sincerely,
Prof. Charles Lane
Dept. of Physics
Drexel University
Philadelphia, PA

I have written about intermittents at least once before, in "Now You See It," Mid-December 1995. But I didn't have many answers, either!

Dear Stan,

[Re: the January/February 2007 Editorial]

I *am* English . . . but please, what *is* cheesesteak?

Ted Truscoe
Horley
Surrey
England

Ah, I suppose I should have thought to explain that—probably a lot of Americans don't know either. I didn't till the first time I visited Philadelphia, where it's a regional specialty: a sandwich made of thinly sliced grilled beef piled on a long roll with cheese melted over it, sometimes with variations such as sautéed onions and/or peppers added.

Hi Dr. Schmidt,

While some people may enjoy Rajnar Vajra's stories or ramblings, I do not believe any science fiction buff does. His stories are more like fantasy and don't belong in *Analog*. Other than that, keep up the good work.

Peter Asselyn
Durham, ME

I'm sorry you don't like these stories, but our mail and reader comments on our website say loud and clear that a great many science fiction buffs are very enthusiastic about them. It's important to understand the difference between "I don't like X" and "No right-thinking person could possibly like X." In this particular case, I can't help wondering how many of Vajra's stories you've actually finished reading. It's true that they often start out looking *like fantasy, but if you read them all the way through and pay attention, they turn out to be very solidly* Analog-

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ish science fiction.

Stan,

Re: How to Write Something You Don't Know Anything About

I really enjoyed Richard Lovett's article on writing about a topic where one initially has no knowledge of the subject matter. I had never thought about the problems faced by science writers. But, after reading the article, I realized we are brothers-in-arms.

During the last ten or so years of my aerospace engineering career prior to retiring, I was called a "systems engineer." Now, this has many diverse meanings depending on the field and the employing company. It makes job-hunting difficult because no one knows what you did without a lot of arm-waving explanation. Even in the organization that employed me for thirty years, I was often asked, "What is it you do?" or told, "Why are you sticking your nose in? You don't understand it and it isn't your responsibility anyway."

As a systems engineer, I had overall technical responsibility for the design and fabrication of complex communication systems that included radio, digital, command and control, power, and mechanical components, most of which I initially knew nothing about. In one case my responsibility even included buildings, latrines, and roads. Of course there was at least one expert on the job in each area, but when it came to making tradeoffs, that was my job.

What all this bragging means is that I had to and did pick the brains of my resident experts, read up on several technical specialties, and just be curious about everything. In systems engineering there is even a name for the process; it's called "buttonhooking." One drops one's "buttonhook" deeply into the specialties involved and pulls up just enough knowledge to solve the immediate problem. I did everything that Lovett recommends and (no pun intended) loved it. Always interesting and never boring.

Regards,
Sam Brunstein
Prescott Valley, AZ ■

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UPCOMING EVENTS Anthony Lewis

8–11 February 2007
CAPRICON XXVII: A CELEBRATION OF HIGH FANTASY (Fantasy conference) at Sheraton Chicago Northwest, Arlington Heights IL. Guest of Honor: Lois McMaster Bujold. Artist Guest of Honor: Erin McKee. Fan Guest of Honor: Cat Faber. Registration: $70 at door. Info: http://capricon.org/capricon27; info@ capricon.org.

16–18 February 2007
BOSKONE 44 (New England SF conference) at Westin Waterfront, Boston MA. Guest of Honor: David Gerrold. Official Artist: Gary A. Lippincott. Special Guest: Br. Guy Consolmagno, S.J.; Featured Filkers: Lee and Barry Gold. Registration: $44 to 16 January 2007, more at the door. Info: www.nesfa.org/boskone; b44info@boskone.org; Box 809, Framingham MA 01701; fax: (617) 776-3243.

2–4 March 2007
MARSCON 2007 (Indiana area SF conference) at Holiday Inn Select, Bloomington MN. Guest of Honor: Eleanor Arnason. Actor Guests of Honor: Don S. Davis and Gary Jones. Artist Guest of Honor: Todd Lockwood. Media Fan Guest of Honor: Eric Larson. Registration: $45 until 31 January 2007, $55 at the door. Info: http://marscon.org/2007; info07@marscon.org; MarsCon, Box 21213, Eagan MN 55121.

9–11 March 2007
POTLATCH 16 (Northwest SF conference) at Red Lion Hotel Portland-Convention Center, Portland OR. Membership: $35 to April 30, 2006. Info: www.spiritone.com/~jlorentz/potlatch; potlatch16@gmail.com; Potlatch 16 c/o OSFCI, Box 5703, Portland OR 97228-5703; (503) 283-0802.

29 March–1 April 2007
WORLD HORROR CONVENTION 2007 (Horror conference) at Toronto Marriott Downtown Eaton Center, Toronto, Ontario, Canada. Guests of Honor: Michael Marshall Smith, Nancy Kilpatrick. Artist Guest of Honor: John Picacio. MC: Sephera Giron. Publisher Guest of Honor: Peter Crowther. Editor Guest of Honor: Don Hutchison. Info: www.whc2007.org; Amanda@whc2007.org.

30 August–3 September 2007
NIPPON 2007 (65th World Science Fiction Convention) at Pacifico Yokohama, Yokohama, Japan. Guests of Honor: Sakyo Komatsu and David Brin. Artist Guests of Honor: Yoshitaka Amano and Michael Whelan. Fan Guest of Honor: Takumi Shibano. Registration: USD 220; JPY 26,000; GBP 125; EUR 186 until 30 June 2007; supporting membership USD 50; JPY 6,000; GBP 28; EUR 45. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Nominate and vote for the Hugos. This is only the third time Worldcon will be held in a non-English speaking country and the first time in Asia. Info: www.nippon2007.org; info@nippon2007.org. Nippon 2007/JASFIC, 4-20-5-604, Mure, Mitaka, Tokyo 181-0002. North American agent: Peggy Rae Sapienza, Nippon 2007, PO Box 314, Annapolis Junction, MD 20701, USA. UK agent: Andrew A. Adams, 23 Ivydene Road, Reading RG30 1HT, England, U.K. European agent: Vincent Doherty, Koninginnegracht 75a, 2514A Den Haag, Netherlands. Australian agent: Craig Macbride, Box 274, World Trade Centre, Victoria, 8005 Australia. ■

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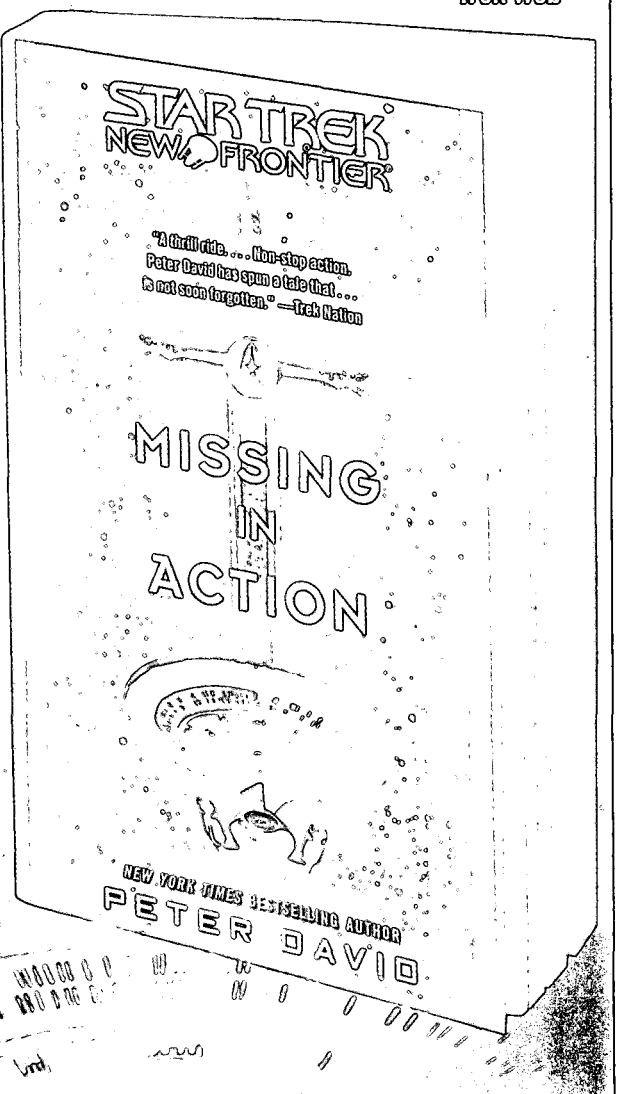
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